KNOWLEDGE

NO. 128 VOLUME II The colour magazine which grows into an encyclopaedia EVERY MONDAY 2/-

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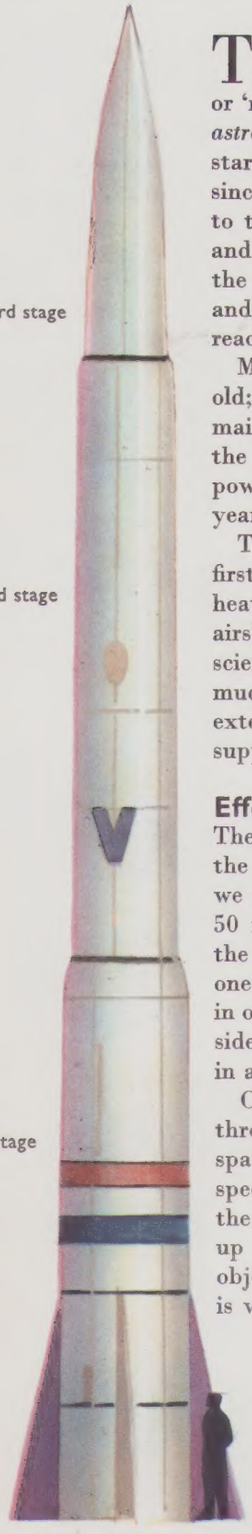
S SPACE FLIGHT



A three-stage rocket. The first stage provides the initial thrust from the launching pad and falls away when the second stage takes over. Only the third stage carries on into space

THE correct term for travelling in space beyond the earth's atmosphere is *astronautics*, or 'navigation among the stars' (from the Greek *astron*, star, and *naus*, ship). To include the stars in this expression is perhaps a bit rash, since at best we may expect to send a space-ship to the moon (which has already been encircled and also hit by rockets from the earth) and to the planets. The stars lie very much farther away and such distances are unlikely ever to be reached directly from the earth.

Mechanical flight itself is only about 60 years old; space flight has only just begun. But the main instrument that enables us to get beyond the atmosphere – the rocket – is quite old. Gunpowder rockets were known to the Chinese 700 years ago, and were used by them as weapons.

Towards the end of the 18th century, when the first flights were made in balloons filled with heated air, a German described a voyage in an airship to the planet Mars (perhaps the first science fiction). But at that time no one knew much about the earth's atmosphere: how far it extended, what it was made of, and its role in supporting life and, in particular, breathing.

Effects of the atmosphere

The atmosphere is a layer of air which surrounds the earth. Its precise height is uncertain, but we do know that there is very little of it above 50 miles high. This layer of air is involved in the problem of space flight in two ways. On the one hand, ordinary engines need the atmosphere in order to work. So when we want to travel outside the atmosphere, we need engines that work in a different way, as rockets do.

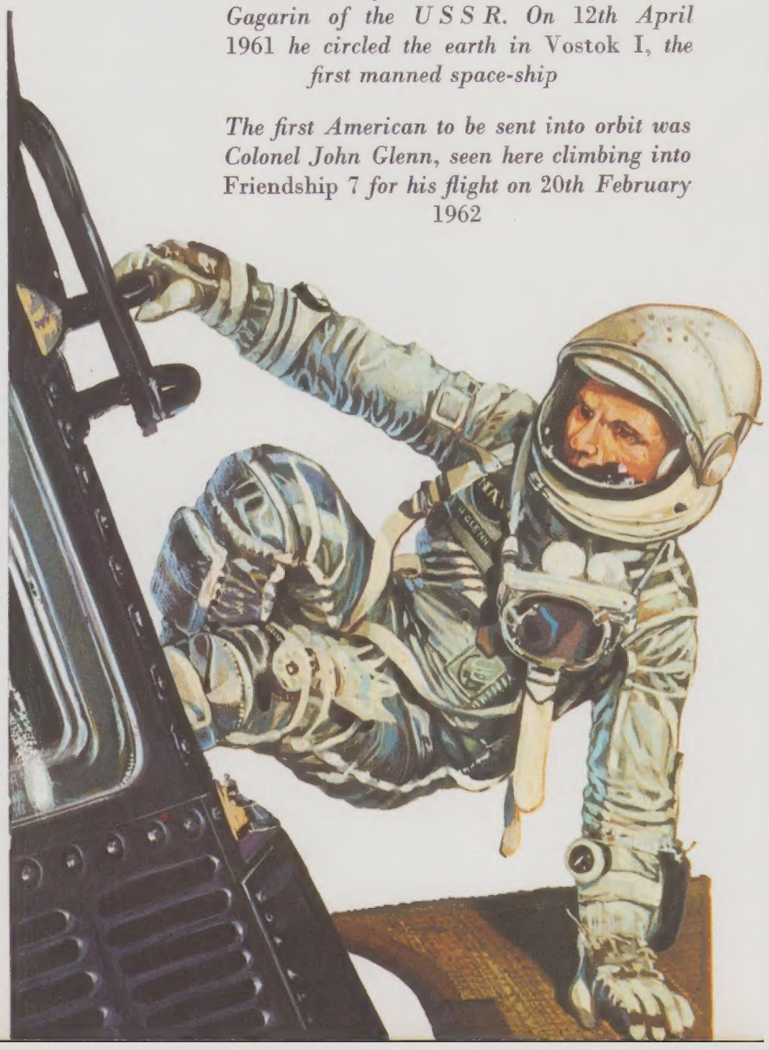
On the other hand, when a rocket travels through the atmosphere on its way to outer space, it is slowed up by friction. Indeed, at the speeds required for a rocket to lift into orbit, the danger is that the whole machine will burn up through friction. The same is true of an object like a satellite returning to earth. This is what happens to some meteorites; they burn up on entering the earth's atmosphere and are seen as 'shooting stars'.

At the beginning of the 20th century space flight was seriously studied by K. Ziolkovsy in Russia, R. H. Goddard in the United States, and H. Oberth in Germany.

In 1937 the German scientist Wernher von Braun (now an American citizen) started work at a rocket base at Peenemünde. During the Second World War the Germans experi-

The world's first astronaut, Major Yuri Gagarin of the U S S R. On 12th April 1961 he circled the earth in Vostok I, the first manned space-ship

The first American to be sent into orbit was Colonel John Glenn, seen here climbing into Friendship 7 for his flight on 20th February 1962



Previous page: An artist's impression of a space-ship of the future with, on the left, a space station which has been assembled from parts sent separately into orbit.

KNOWLEDGE NEWS

Week beginning 16th June 1963

Jardine

Bradman

Larwood

Voce

McCabe

Wesley Hall

BODYLINE

THE two fastest bowlers in the world are at present in England with the West Indies touring team: Charlie Griffith, who recently knocked out two Yorkshire batsmen with balls travelling at about 80 mph, and Wesley Hall, who is even faster. Their speed has already revived memories of the famous 'bodyline' tour – the greatest crisis in the history of cricket.

THE ball was hurled down the wicket at nearly 100 mph. There was a dull thud and the Australian opening batsman dropped like a stone as the ball smacked against his heart. All the players gathered round the prone figure of W. Woodfull, and the Adelaide crowd howled their disgust at Larwood, the demon bowler. But he and his captain, Douglas Jardine, were unmoved. They packed the fieldsmen round the new batsman, and Larwood continued to bowl at his wickedly fast pace. Not long afterwards tragedy struck again. Larwood bowled a ball that reared up at the Australian wicket-keeper, Bert Oldfield. The ball caught the edge of the bat, and flew on to his head. Oldfield dropped, stunned, to the ground.

Behind the disapproving roar of the crowd, hurried conferences were taking place in the pavilion. The Australian Board of Control sent an urgent telegram to the MCC complaining that, if this 'bodyline' bowling were not stopped, the friendly relations existing between England and Australia might be upset. The MCC replied that if Australia wished, they could abandon the series, but this disastrous step was not taken. Instead the cricket continued in a most unpleasant atmosphere. In the fifth and final Test Match, the Australian fast bowler H. Alexander bowled a furious bumper at the English captain, and the crowd cheered wildly, for Jardine was the inventor of bodyline.

Bodyline was a weapon invented mainly to combat one man – Don Bradman, who in the previous Test series against England had had a batting average of 139·14.

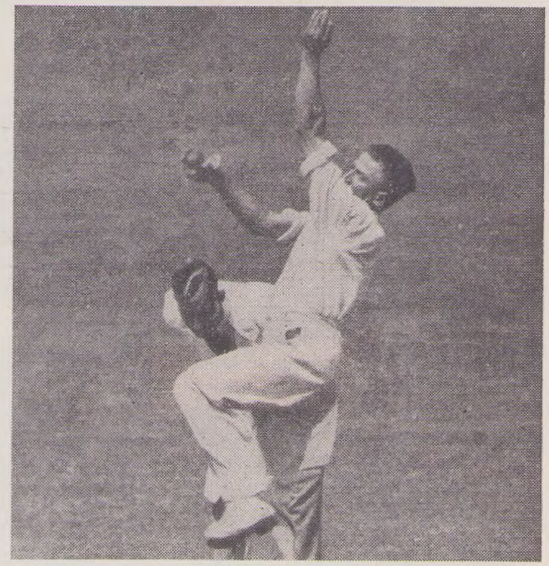
When England went to Australia in 1932, they had as the spearhead of their attack Harold Larwood, the ex-miner from Nottingham, who was possibly the fastest bowler the world has ever seen. And there was also Bill Voce, also of Nottingham, who with his lightning left-armers could make a ball swing furiously into a right-handed batsman. But the plan was based not only on the pace but on the direction of the bowling. If the ball was bowled on or outside the leg stump, the batsman either had to fend it off into the cluster of eager short-leg fieldsmen or, if he could not jump out of the way, risk severe injury. Bodyline worked; Bradman admittedly still topped the Australian averages with 56·57, but for the only time in his life was reduced to relatively ordinary figures. Even so he was compelled to resort to a revolutionary way of batting. He took guard more than a foot outside the leg stump, defying the bowler to attack his unguarded stumps. Then he would jump across and hit the ball through the covers, or hook it murderously to the leg side. But his less fleet-footed colleagues had no such remedy. They had to stand firm as they were battered and bruised by the English thunderbolts, even though they were heavily padded on their thighs, stomachs, and shoulders. This grim situation produced one of the most dazzling innings in the history of cricket – McCabe's 187 not out in the first innings of the series.

Bodyline left an ugly scar on cricket. The MCC introduced legislation instructing umpires to prevent dangerous bowling. Three careers were ruined, and one character changed. In the next series between England and Australia in 1934, Jardine, Larwood, and Voce were not chosen for England. A Bradman innings was never the same lighthearted, joyous affair it had been before the bodyline season; it was from this date that he began to earn the label of the most ruthless batsman and later the most ruthless captain that cricket has ever known.

Don Bradman – he scored a century on an average every third innings. He finished the 1932–33 series with an average of 56·57, his lowest in any series.

* * *

Harold Larwood, probably the fastest bowler the world has ever seen. His bowling caused a crisis between Australia and England, earned him the hatred of many Australian fans, and cowed all of the Australian batsmen except Bradman and possibly McCabe.



* * *

W. Voce, the left-arm bowler whose lightning in-swingers and speed off the pitch helped to shatter Australian morale.

The Australian openers, Woodfull (left) and Ponsford (right), who had to bear the brunt of the English attack.

THE AUSTRALIAN SCOREBOARD AT THE FIRST TEST AT SYDNEY (DECEMBER 2-7th, 1932) SHOWS HOW ENGLAND'S BODYLINE ATTACK HAD STRUCK HOME

1st Innings		2nd Innings	
W. M. Woodfull c Ames b Voce	7	b Larwood	0
W. H. Ponsford b Larwood	32	b Voce	2
J. H. Fingleton c Allen b Larwood	26	c Voce b Larwood	40
A. Kippax lbw b Larwood	8	b Larwood	19
S. McCabe not out	187	lbw b Hammond	32
V. Y. Richardson c Hammond b Voce	49	c Voce b Hammond	0
W. A. Oldfield c Ames b Larwood	4	c Leyland b Larwood	1
C. V. Grimmett c Ames b Voce	19	c Allen b Larwood	5
V. Nagel b Larwood	0	not out	21
W. O'Reilly b Voce	4	b Voce	7
T. Wall c Allen b Hammond	4	c Ames b Allen	20
Extras	20	Extras	17
Total	360	Total	164

(BRADMAN WAS ABSENT THROUGH ILLNESS)

DANGEROUS EGGS

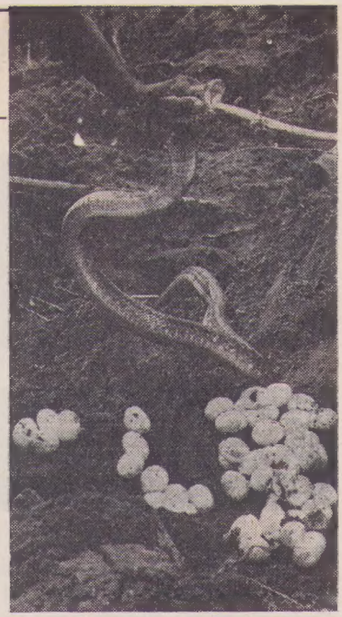
Letter from the Editor

37 HERTFORD ST.
LONDON W.1

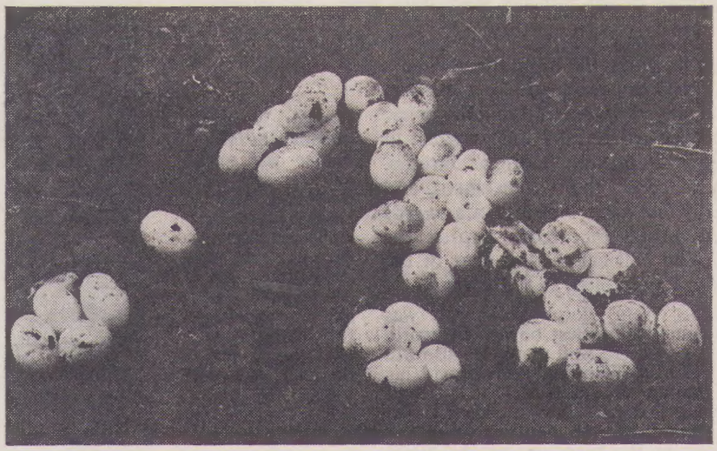
WITH its hood expanded, the big cobra suddenly reared up from the earth. It took a quick look round; then flung itself forward in a desperate effort to get away. But Raju, the local snake-man, was quicker. His waiting stick pinned the snake's head to the ground. . . .

The cobra had been found in a little village near Madras. Workmen had been digging an earthen bank when they came upon the hissing angry snake beneath an asbestos sheet, guarding a pile of eggs. The village snake-man was summoned – and so the cobra was caught.

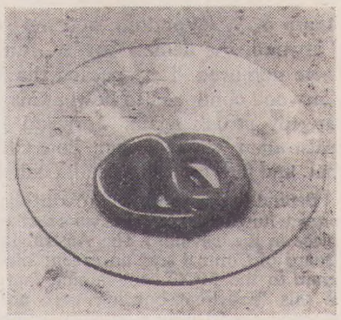
When the snake had been measured and photographed, it was released. The eggs were kept, however, though forgotten for two weeks. Then a dark slender object was noticed among them – in the next four days 18 other cobras were born, each about a foot long. Here is their story told in pictures, starting with the capture of the snake that laid the dangerous eggs.



After he has caught the snake Raju picks it up by its jaws in such a way that it cannot bite him. When the cobra was measured it was found to be 4 feet 9 inches long – it was released in a nearby rice-field.



There were 49 eggs – this picture shows only 43, as the others were smashed by the workmen. Before this the highest number of eggs recorded as having been discovered in a cobra's nest was 45. Only 20 eggs in the record-breaking nest remained unscathed. These eggs were put in a box of damp earth covered by a sheet of glass.



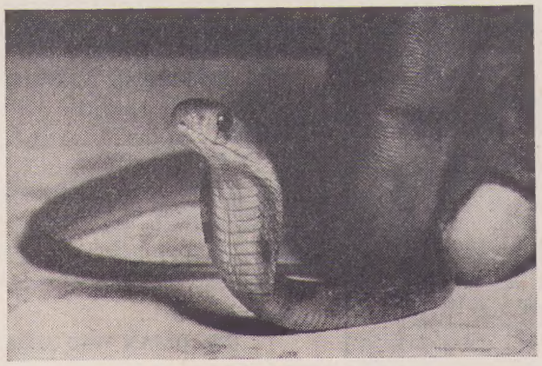
The broken eggs contained embryo cobras – here is one of them still alive, after having been extracted from its placenta and shell. It weighed 3·2 grams and was 8 inches long.

Per ardua ad astra

What about the stars? There might well be life similar to ours on many of them, but you and I are never likely to find out if this is so. If we wished to travel to the nearest star, Proxima Centauri, and we were moving at the speed of light (186,300 miles a second), it would take us over four years to complete the journey; which means that Proxima Centauri is about 26,000,000,000,000 miles away. Some stars in the universe are so far away that the light that is now reaching the Earth was transmitted from them millions of years ago. The light we can see coming from Andromeda Nebula was transmitted about 2,000,000 years ago.

Travel to many of the stars would, anyway, probably be out of the question, as travellers could die of old age before they got there, although it has been argued that, while travelling through space, men would not age at all.

John Chancellor



After two weeks the cobras began to hatch out (above left). The snakes' heads appeared first, surrounded by a great deal of froth. They seemed to study the world carefully before emerging from the egg. When satisfied, they would shoot out at high speed.

* * *

Raju was often bitten by the young snakes. Above, one of them sinks its fangs into his thumb. Although the bites of these tiny cobras are extremely poisonous, Raju suffered no ill effects other than a swollen thumb, and slight bleeding where the fangs had penetrated his skin. He merely applied a poultice of moist leaves to the bites, claiming that he had eaten some herbs which gave him immunity.

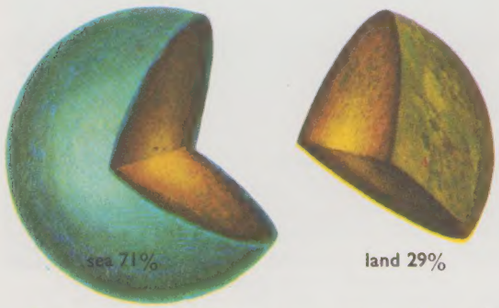
* * *

The young cobras were extremely active, darting around and spreading their hoods (left), striking fiercely at any moving object, although ignoring each other. They were offered insects and small frogs, but refused them. They very much enjoyed lying in a tin of water provided for them.

Lands and oceans of the world

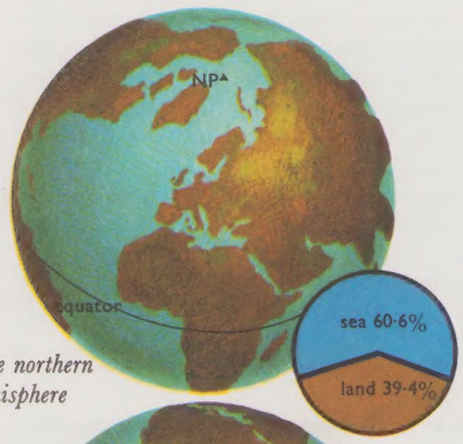
HAVE you ever stopped to consider what the earth you live on is really like? In early times people thought that it was flat, but we now know it is shaped like a sphere which has been slightly flattened at the poles, so that the equatorial diameter, which is the greater, is 7,926 miles, and the polar diameter is only 7,899 miles.

If you were in a space capsule encircling the earth, this polar flattening would scarcely be noticeable. You would, however, be able to notice the main feature of the earth's surface, which is the remarkable distribution of the land and sea. Living on the land we tend to regard it as the most important part of the world, but in fact the continents form the lesser part of the earth's surface. The continental land masses are very large islands which are surrounded by the even larger ocean basins, so that from afar you would see a world that is largely sea.

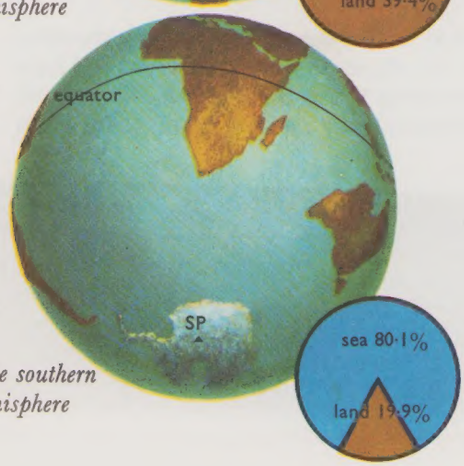


The proportion of land and sea on the earth's surface

The total surface area of the earth is approximately 197,000,000 square miles. Of this area about 141,000,000 square miles (about 71 per cent) are covered by the sea, while the remaining 56,000,000 square miles formed by the earth's land make up only about 29 per cent of the total surface area.



The northern hemisphere



The southern hemisphere

A glance at a map of the world, or better still at a globe, will show that land and sea are not distributed evenly over the earth's surface.

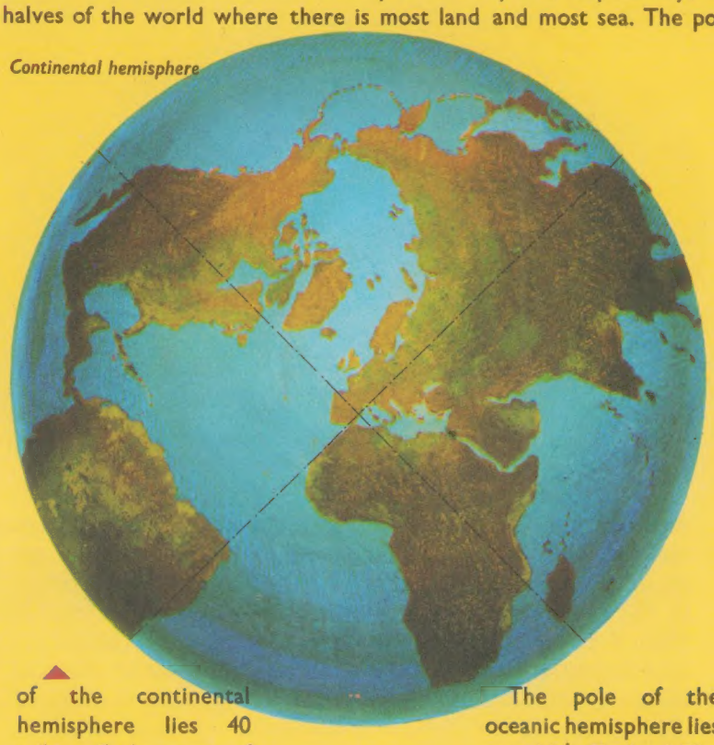
Most of the land is in the northern hemisphere, while the southern hemisphere is almost entirely oceanic.

This grouping of the continental masses is so clearly marked that geographers speak of the continental hemisphere and the oceanic hemisphere of the world.

THE CONTINENTAL AND OCEANIC HEMISPHERES

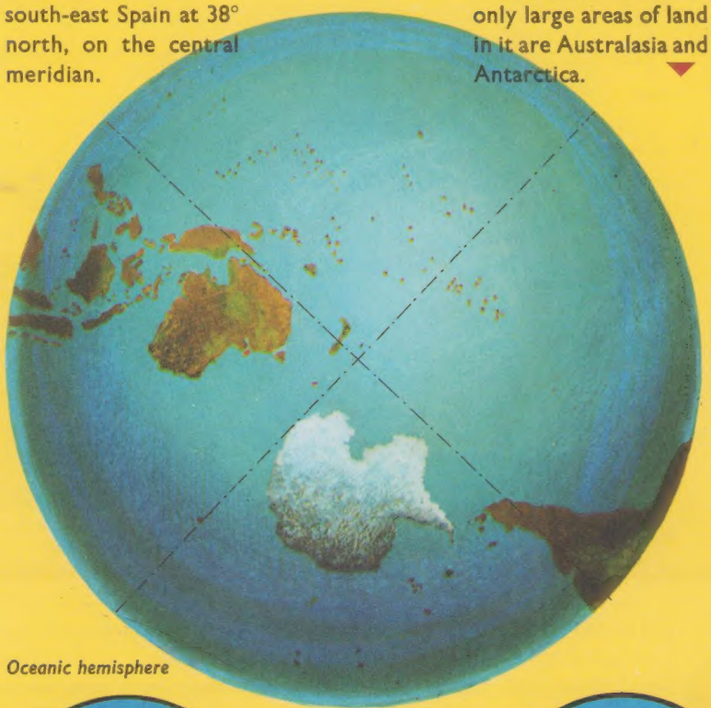
The continental and oceanic hemispheres do not correspond exactly to the northern and southern hemispheres. They are, respectively, the halves of the world where there is most land and most sea. The pole

Continental hemisphere

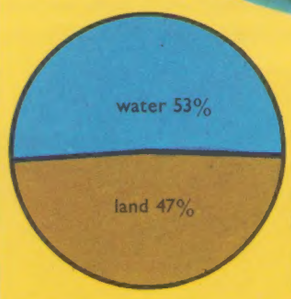


of the continental hemisphere lies 40 miles off the coast of south-east Spain at 38° north, on the central meridian.

The pole of the oceanic hemisphere lies near New Zealand. The only large areas of land in it are Australasia and Antarctica.

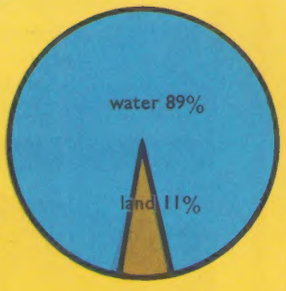


Oceanic hemisphere



Continental hemisphere

Over half the continental hemisphere is covered by water, although it contains 83 per cent of the earth's land. The oceanic hemisphere is 89 per cent water.

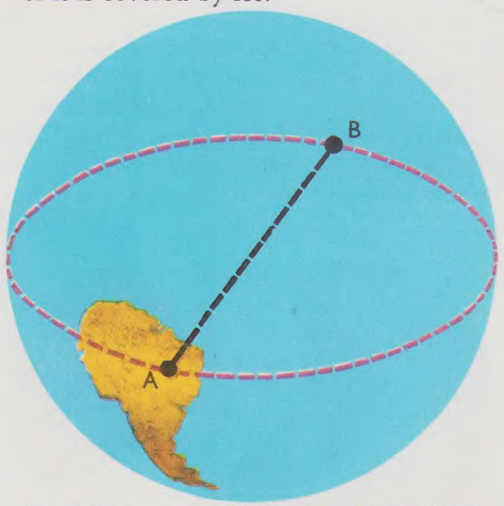


Oceanic hemisphere

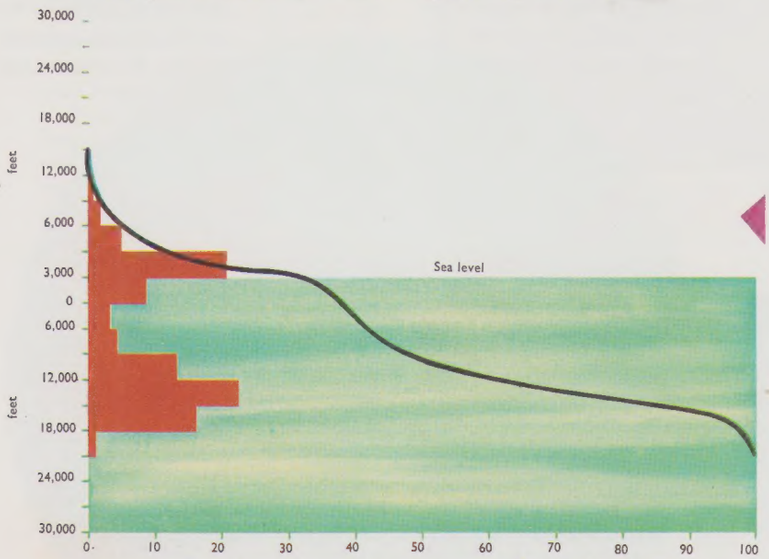
THE FORM OF THE CONTINENTS

The concentration of land in northern latitudes is partly the result of the tapering of all the larger continents southward. North America tapers to Florida and Central America; South America to Tierra del Fuego; Asia to India and the Malay peninsula; and Africa to the Cape of Good Hope. Australia and Antarctica are the only two large land masses that do not have this tapering shape. Antarctica is the only large land mass south of latitude 30° south, and its dimensions are still not clearly known as most of it is covered by ice.

Another notable feature of the earth is the *antipodal* arrangement of land and sea. This means that for nearly every land-mass on one side of the globe there is sea on the part of the earth diametrically opposite. This is best seen in the antipodal position of the Arctic Ocean and the Antarctic continent around the north and south poles respectively. While the antipodal relationship is not so exact elsewhere, still 75 per cent of the land lies opposite the Pacific Ocean, and the only marked exception to the rule of antipodal opposition is southern America, which is opposite part of China.



Antipodal arrangement of land and sea. There is land at point A diametrically opposite the sea at point B



Altitudes of earth's surface, and diagram showing 'First Order Relief'

The graphs on the left have been compiled from maps and other information. The individual bars of the graph show the percentage of the earth's surface between the heights or depths given, and the line graph shows the cumulative percentage. These graphs bring out two important facts: (1) the total areas of the highest mountain peaks and the extreme depths of the oceans are very small, and (2) the altitudes of the earth's surface are not evenly distributed by area within the extreme range represented between Mount Everest and the Mariana Trench. There are two dominant levels of the earth's surface. Over 21 per cent of the earth's surface occurs between sea level and 3,300 feet above sea level; and over 23 per cent between 13,000 and 16,000 feet below sea level. These two levels represent the main continental platforms and the ocean basins respectively, and are called the earth's 'First Order Relief' features.

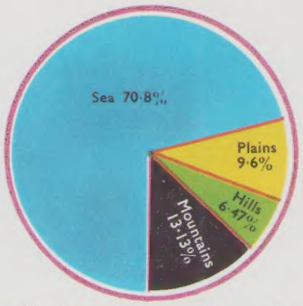
HEIGHTS AND DEPTHS

The heights and depths of the earth's surface vary considerably. The mean (average) height of the land is under 3,000 feet, but altitudes of 29,000 feet are reached in the Himalayas. The mean depth of the ocean is over 13,000 feet, and depths of more than 35,000 feet have been measured by echo sounding in the Pacific Ocean. The greatest depth sounded is in the Mariana Trench which reaches about seven

① The height of Mount Everest in relation to the earth

CHARACTERISTICS OF THE LAND AREAS

It is interesting to note that of the 29·2 per cent of the earth's surface we describe as 'continental', not all is 'free' continental land. The diagram above illustrates this point and shows the areas of islands, lakes, and glaciers, in addition to the land. It can be seen that a very large area – something like 5·6 million square miles (one-tenth) of the land – is covered by ice. The majority of this (96 per cent) is not in the small glaciers and ice caps of the mountainous areas, but forms the great ice sheets of Greenland and Antarctica. A conservative estimate suggests that if all this ice were to melt it would cause the sea level of the world to rise by about 160 to 200 feet.



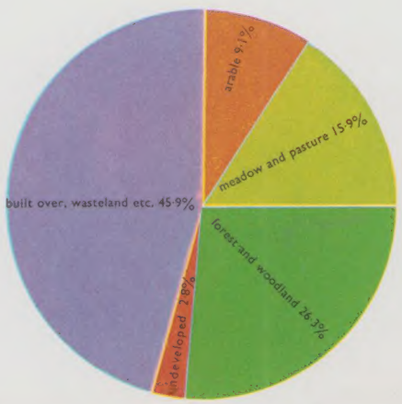
Distribution of the earth's surface

30% of the world's land can be cultivated; 30% is productive but cannot be cultivated; and 40% (deserts, mountains, glaciers, marshland and so on) cannot be cultivated

MAN'S USE OF THE LAND

With land forming such a small proportion of the earth's surface, and with so much of that area covered by ice, it is apparent that the actual amount of land which can be used productively by man is relatively small. The diagram above summarises this position, and shows the part of the earth's surface which is potentially available for man to use productively. It is thought that only about 16 million square miles will ever be able to be cultivated, and something like the same area used for forests, grazing, and so on. The rest of the earth's surface is either too dry, too cold, or otherwise unsuited to productive use.

To give some idea of the way in which the land is being used, the diagram on the right summarises the present-day position (so far as it is possible to obtain figures). From this it may be seen that it is still possible to extend the area of the world which can be cultivated.



miles deep. Put Mount Everest (29,002 feet) in this deep and there would still be more than a mile to spare.

These differences between the greatest heights of the land and the depths of the ocean sound vast, but they are in fact only very small when we consider the size of the earth. The greatest variation of the earth's surface is under 13 miles, which in comparison with a radius of almost 4,000 miles is very little. On an earth the size of a football these differences would be equivalent only to superficial scratching.

IRON OF THE WORLD

IRON is the metal most used by man, and every year about 300 million tons of it are produced throughout the world. Without iron and its alloy steel (see page 225) modern transport, modern architecture, and most of the amenities of modern civilisation would not exist. Our water and gas flow through iron pipes, and the dynamos which generate our electricity depend on the exceptional magnetic properties of iron.

Iron was not the first metal to be used by man. Gold, silver, copper, bronze, and perhaps tin, were known many centuries earlier. Nor is it the easiest of metals to obtain from its ores, but its superior strength, hardness, and toughness, and the great abundance of its ores, led to its rapid acceptance once man had learnt how to smelt it. It is the fourth most common element in the earth's crust, and its ores are found in most of the countries of the world. These occur chiefly as oxides, such as haematite (Fe_2O_3) and magnetite (Fe_3O_4), and as carbonates, the most important of which is siderite ($FeCO_3$).

The amount of metal which can be obtained from ore varies according to the purity of the ore. The purest, or richest, ores known yield almost 70 per cent of their weight of metal. It is not usually worth smelting ores with less than about 21 per cent of the metal. Metallic iron is obtained by blowing heated air through a mixture of ore, limestone, and coke in huge tower-shaped blast furnaces at a temperature of about 1300°C. The molten iron is run off from the bottom of the furnace and is then further treated to produce the different types of iron and steel needed for use.

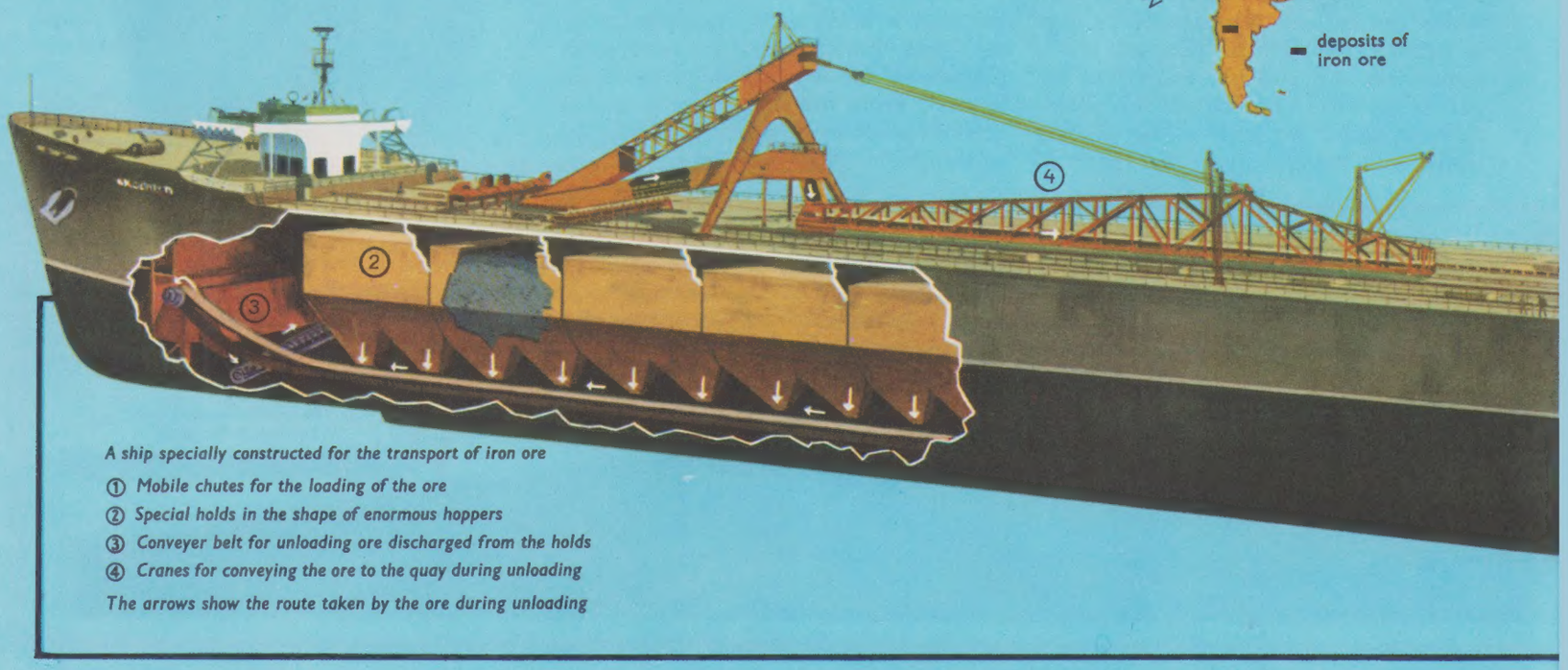
The chief iron-ore-producing countries are listed in the table below. Since much ore is exported and smelted outside the country which produced it, the amount of steel produced in each country is not necessarily related to the amount of ore mined there.

ESTIMATED IRON ORE AND STEEL PRODUCTION IN MILLIONS OF TONS (1962)

	Ore	Steel		Ore	Steel
Russia	124·8	74·0	West Germany	16·4	32·0
USA	75·2	87·8	United Kingdom	15·3	20·5
France	65·2	17·0	Venezuela	13·1	—
China	60·0	18·0	India	12·6	4·8
Canada	25·9	6·4	Brazil	7·2	2·4
Sweden	24·0	3·5	Luxembourg	6·2	3·9

USSR AND ASIA

The country with the largest reserves of iron ore is the USSR. During recent years the production of ore in the Soviet Union has exceeded that of the United States, and the production of metal has also risen sharply. Although no accurate figures are available, Chinese production has probably increased five-fold over the last 10 years, and China now ranks as one of the chief iron-producing countries of the world. Large quantities of ore are smelted in Japan, but most of it is imported. Most of the ore mined in India used to be exported, but there is now an expanding steelmaking industry there. The continent of Asia now produces about a third of the world's steel.



A ship specially constructed for the transport of iron ore

① *Mobile chutes for the loading of the ore*
② *Special holds in the shape of enormous hoppers*
③ *Conveyer belt for unloading ore discharged from the holds*
④ *Cranes for conveying the ore to the quay during unloading*

The arrows show the route taken by the ore during unloading

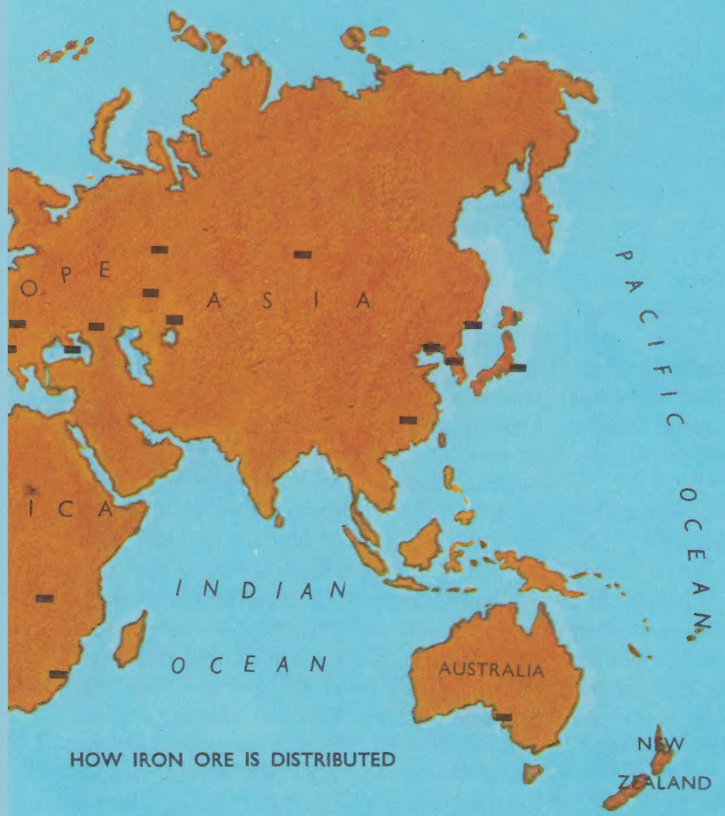
AMERICA

The richest iron-ore-producing area in the world lies in Minnesota near Lake Superior. This area produces seven-eighths of the total ore mined in the United States, and although the deposits of ore are almost 1,000 miles from deposits of coal suitable for smelting them, the cheapness of water transport on the Great Lakes and the high percentage of metal in the ore (about 60 per cent) make economic production possible. The chief steel-producing centres are Pittsburgh, Chicago, and Detroit, and ore is also imported from Canada for smelting in these centres. Some of the deposits of ore found in Minnesota are very near to the surface and are extracted by open-cast working in huge quarries. Much of the ore here, and the other American ore found in the Appalachian Mountains, is deep underground and mines may be up to 3,000 feet deep.

In Canada the main deposits of ore are found in the east, particularly in Labrador and Newfoundland.

In South America, Brazil, Venezuela, and Chile produce quite large quantities of ore, but little of it is smelted in these countries because of shortage of fuel and poor transport facilities. Large untapped deposits probably occur in inaccessible inland areas. Despite the comparative abundance of ore in these areas, iron was unknown to the early civilisations.

Open-cast iron workings in Minnesota



HOW IRON ORE IS DISTRIBUTED

EUROPE

Europe was the cradle of the iron and steel industry and remained for centuries the chief producer of the metal. Not only are there abundant deposits of ore in Europe, but fuel and limestone needed for the smelting processes are also found in large quantities conveniently near to the iron ore deposits.

France has the largest deposits of any European country, and the Lorraine iron-ore fields, which extend into Belgium and Luxembourg, supply ore to the blast furnaces of many European countries. In Great Britain the deposits of ore are found mainly in the Midlands and the north, especially in Northamptonshire and Leicestershire, where supplies of coal and limestone can easily be obtained.

Most European iron ore is of a comparatively low grade, and in addition the best ores have already been mined. The ores of France may contain about 35 per cent of the metal, while those of Great Britain often only contain about 27 per cent. Sweden alone among European countries produces rich ores, and the best Swedish ore contains almost 70 per cent of the metal. This is richer than the best American ore and indeed than any other ore in the world. Sweden's largest deposits are found in Lapland, and because of a shortage of fuel in that region most of it is exported.

Iron ore is mined in most countries of Europe. Spain, Austria, Poland, Czechoslovakia, and Norway all produce between 2 and 6 million tons a year.

Most of the ore in Europe is deep underground and is mined from a depth of several hundred feet.

Mechanical shovelling of deep-mined ore

AUSTRALIA

The chief ore-producing areas are in South Australia and in Western Australia, where vast new reserves have recently been discovered. Smelting is concentrated in New South Wales, and the ore is shipped by sea from the mines to the smelting furnaces. Limestone and coal occur in New South Wales and South Australia.

AFRICA

Comparatively little iron ore is mined in Africa, although major developments are under way in Liberia and Mauritania. The steel industry has grown considerably in South Africa since the war, and steel production is now about 2½ million tons a year. Large deposits of ore have recently been found in Guinea.

THE CONGO: history

THE Congo is a land of dense forests, great rivers and lakes, snow-covered mountains, and plains where more wild creatures live than anywhere else on earth. It produces rubber, ivory, cotton, palm-oil, and, in Katanga, copper, uranium, industrial diamonds, cobalt, gold, and other minerals.

The Christian kingdom of Congo

The Portuguese discovered the Congo in 1482. They were well received by the natives; the kings or chiefs became Christian, and one prince was even consecrated a bishop. Many Congolese were educated in Portugal. But the Christian kingdom of Congo survived less than 200 years. It was followed by the slave trade, with all its horrors.

Slavery had existed in Africa long before white men came, but the trade was never so highly organised and profitable as in the 17th and 18th centuries. By the mid-19th century it had ended, and exploration of the African interior began.

19th-century developments

David Livingstone discovered the source of the river Congo in the north-flowing stream which he thought was the source of the Nile. When H. M. Stanley found Livingstone at Ujiji in Tanganyika, he promised to carry on the work of exploration. Starting from the east coast opposite Zanzibar in 1874, he reached the Congo estuary in August 1877, after a terrible journey.

Meanwhile Leopold II, King of the Belgians, had seen new prospects of wealth and power in Africa. He started an International African Association to explore the unknown continent and bring civilisation to its people. Leopold sent Stanley back to the Congo, where he made treaties with hundreds of African rulers. Stanley made roads and founded trading posts along the river. In 1884 a Conference was called in Berlin to settle the Congo's future; Europe and the United States recognised the 'Congo Free State' as the personal responsibility of King Leopold, who became owner of its 900,000 square miles.

H. M. Stanley, the explorer

King Leopold II of Belgium

In 1885 he decreed that all vacant land was the property of the state, and in 1891 that all rubber and ivory produced on this land was state property. African villages had to provide labourers to gather rubber, as a way of paying taxes. Local agents were put in charge of these arrangements, and the Congolese had to work long, exhausting hours and were cruelly punished if they did not produce enough.

Rule by the Belgian Government

In time, reports from travellers, missionaries, and foreign consuls led to violent criticism of the methods of Leopold's agents. Congo Reform Societies in Britain and America, backed up by many people in Belgium itself, campaigned against the system and demanded action from the Belgian Parliament. At last, in 1908, the Congo Free State was taken over by the Belgian Government and renamed the Belgian Congo. Reforms followed quickly. The Belgians provided work, primary and technical schools, hospitals, good roads, railways, and airports. The Congolese had more money and goods to spend it on, and their numbers rose with the greater prosperity. But although many children went to primary schools, only a few went on to secondary schools and to vocational training schools. Two colleges were founded in 1956, but hardly any Congolese students went abroad, as British and French colonial students did, to continue their studies. When the Congo became independent in 1960 only one African held a high position in the civil service. There was no professional class to take over government from the Belgian officials; no doctors, lawyers, engineers, or veterinary surgeons – only medical orderlies, clerks, and a few students. White men and Congolese lived in different houses, went to different schools and received different wages for the same work; the 113,000 white people lived far more comfortably and got better pay than the 13½ million Africans.

After the Second World War, African parties and associations had grown up, and demands for equality were made, but no elections even for local government were held until 1957. Not until 1959, after serious riots in Leopoldville, the capital, were freedom of speech and the press and free association with white people granted.

In these circumstances, amidst mounting fear and hostility between African and white man, the Belgians announced complete independence for the Congo in June 1960. After independence, a bitter feud developed between the Central Government and the breakaway province of Katanga. The United Nations did much to restore order, but trouble is never far below the surface.

A Congolese village, built between the forest and the river Congo

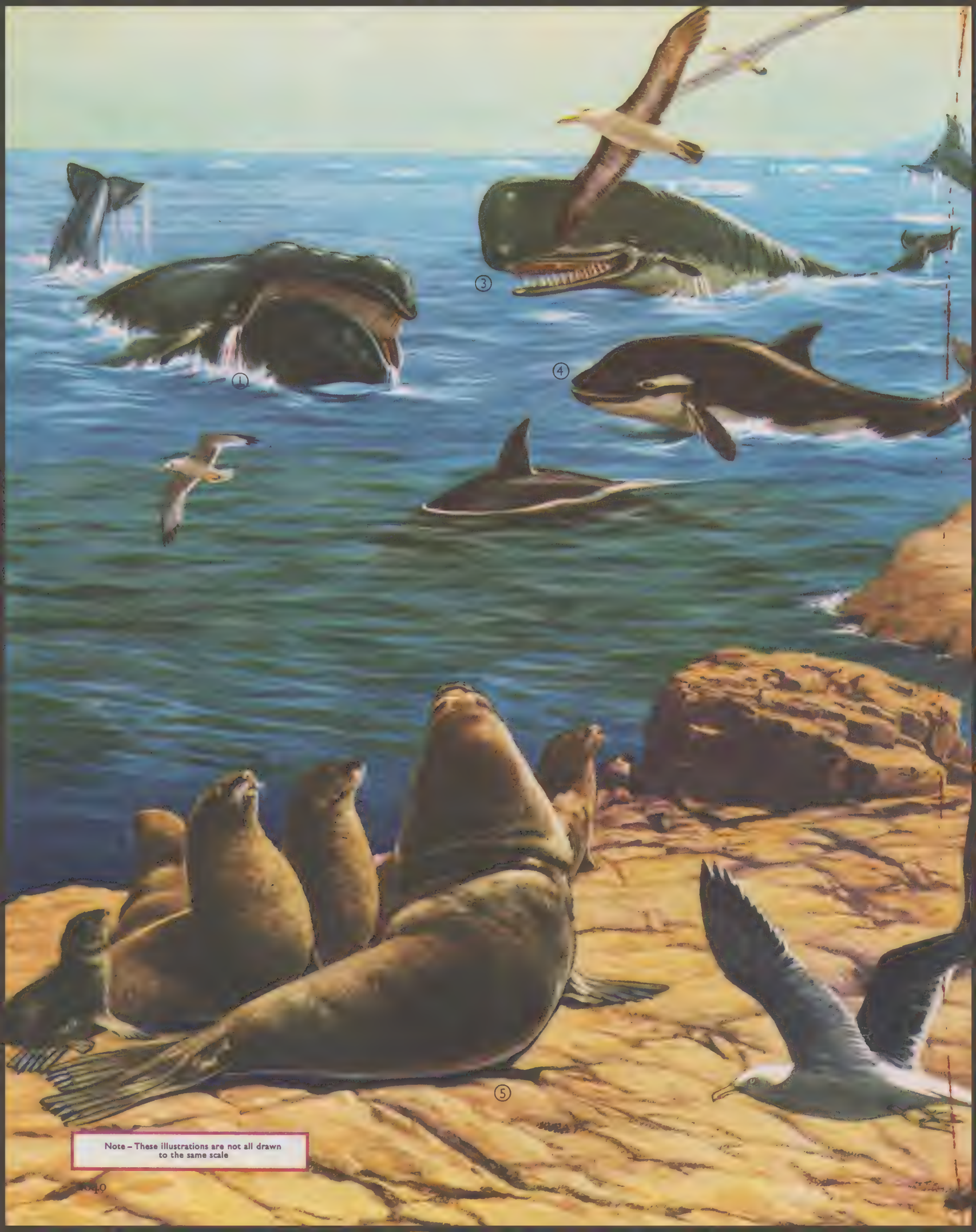
Albatrosses soaring over the cold, storm-tossed waves of the Southern Ocean

FAUNA OF THE ANTARCTIC

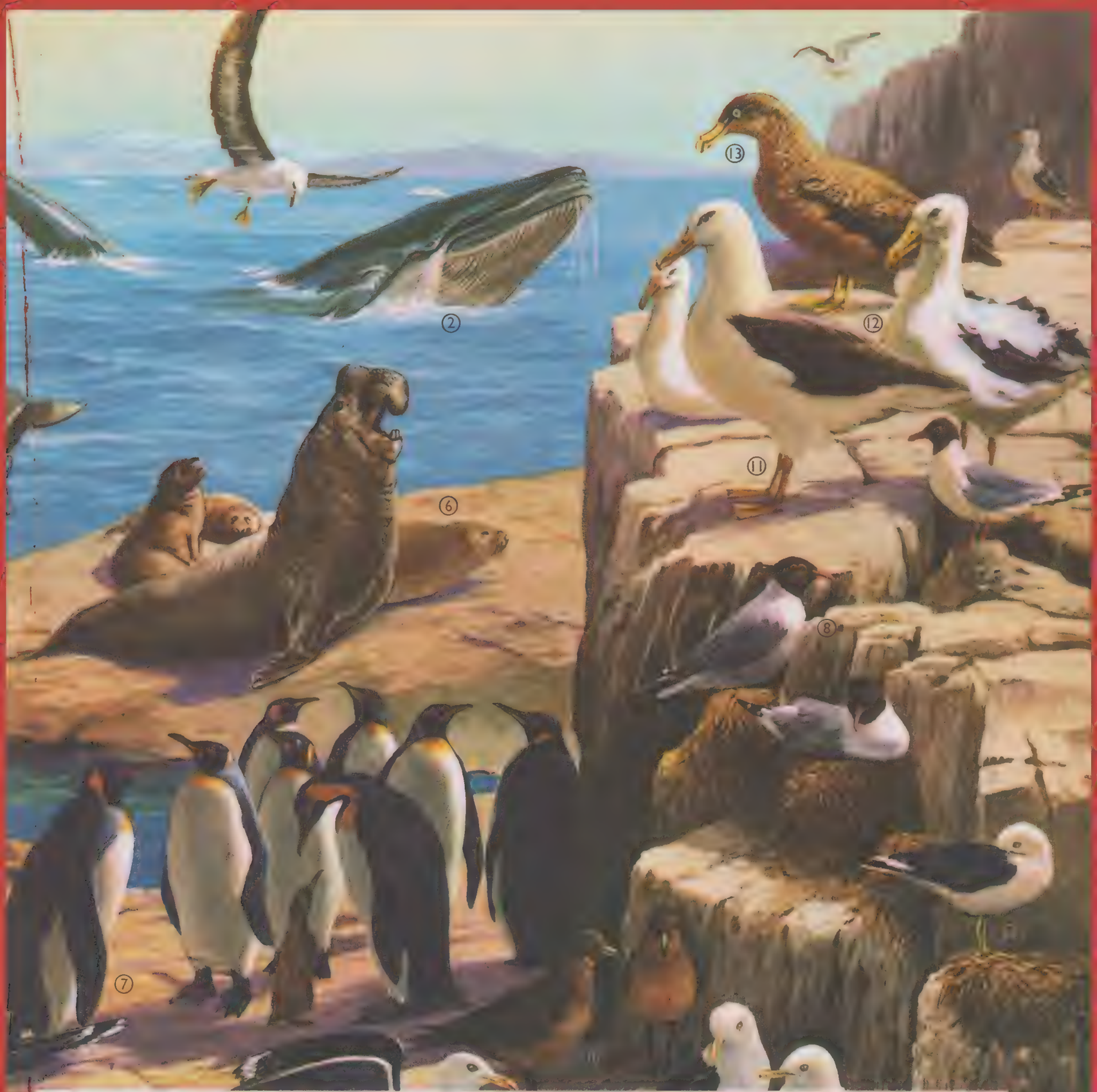
BEFORE the days of the Panama Canal ships sailing between the Atlantic and Pacific Oceans had to round the Horn – that is, to sail south of Cape Horn, the southernmost tip of South America. These were perilous waters for the sailing ships – stormy, cold, and often shrouded in fog – and the superstitious sailors sought eagerly for any sort of sign that they thought might bring them good luck and protect them from danger. Often their ships would be followed, day after day, by great white-and-brown birds which made nothing of the gales and sailed serenely on the stormy air, hardly moving their immense outstretched wings. It is little wonder that the sailors regarded them as guardian spirits, on no account to be harmed, and that a curse descended upon the Ancient Mariner of Coleridge's poem, who had to make the awful confession: 'With my cross-bow I shot the albatross.'

There are 13 different kinds of albatross – the largest of them, being the wandering albatross, whose wings may have a span of nearly 12 feet. All of them live around the edges of the Antarctic continent, breeding mostly on small islands and obtaining their food entirely from the sea. The Antarctic continent, with the South Pole at about its centre, is the most inhospitable region of the world for animal life. It is largely covered by an enormous ice-cap and, apart from a few insects and other minute creatures, has no purely land animals at all. The seas around it, however, are very rich in plankton. This is the name given to the great variety of small marine animals which live in the sea, drifting about with the ocean currents; the most numerous and important of them are certain kinds of small shrimps (Euphansids). The larger animals living in the sea and around the coasts of the Antarctic all live directly or indirectly on this plankton. Some of them are purely marine, like the fishes and whales, others are amphibious, spending their time partly on the land and partly in the water; these include the penguins and other sea birds, and the seals and sea lions.

The penguins are an example of the animals that eat the plankton itself and so feed directly upon it. The leopard seal feeds on penguins, and the seals themselves are preyed upon by the ferocious killer whale. Both the seal and the killer whale are feeding indirectly on plankton. The largest animals of all, the great whales, are direct plankton feeders.



Note – These illustrations are not all drawn to the same scale



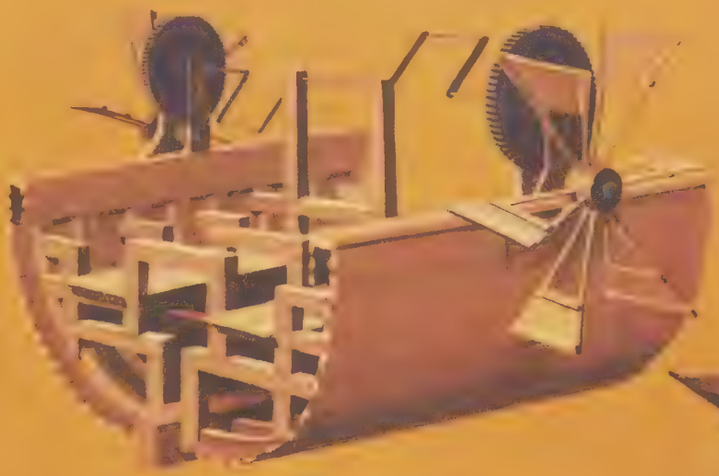
2. Sperm whale. This is the largest of the toothed whales, and feeds on large squids. 4. Killer whale. A ferocious animal feeding on fish, seals, and other whales. 5. Patagonian sea lion. This is the largest of the eared seals or sea lions, it lives in the Falkland Islands and southern South America. 6. Elephant seal. Largest of all the seals, the males may weigh three tons. 7. King penguin. 8. Kittiwake black-headed gull. 9. Southern black-backed gull. Both these kinds of gull are closely related to species found in the northern seas. 10. Southern skua. This bird is rather like a brown gull, but it is a bird of prey, living largely on the eggs and young of other birds. 11. Black-browed albatross. One of the most beautiful of the albatrosses. 12. Wandering albatross. The largest and perhaps the most common of the albatrosses, which we have already mentioned. 13. Giant petrel. The largest of all the petrels, of which the British fulmar is an example.

LEONARDO DA VINCI: ENGINEER (part three)

LEONARDO DA VINCI is often called a genius, partly because of the ingenuity of his inventions, and partly because of the great breadth of his knowledge. He has been spoken of as the forerunner of such men as Francis Bacon, James Watt, and Isaac Newton. Although he did not always anticipate the *discoveries* that these men later made, he often used the same *methods of investigation* as they did. These methods, if he had been able to pursue them, would eventually have led him to their discoveries. Leonardo failed to have any significant influence on scientific progress; nearly all his discoveries and inventions were ignored by, or merely unknown to, the people of his time.

MARINE ENGINEER

Leonardo was particularly interested in the problems of marine engineering, although mainly for the purpose of war. His principal contributions were towards mechanically-propelled vessels.



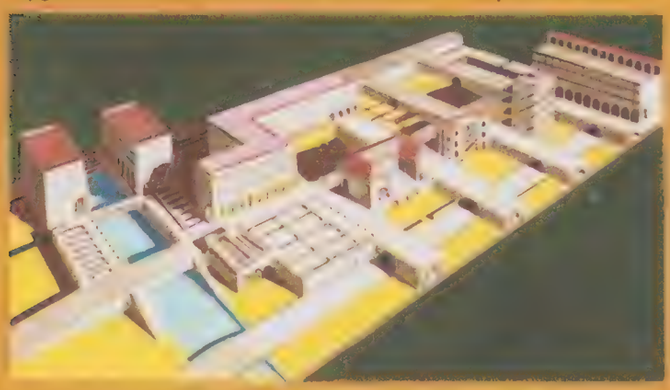
One of Leonardo's designs (*above*) for a mechanically-operated paddle boat. The paddle-wheels were turned by hand; in later sketches more intricate gearing was introduced so that more power could be transmitted to the wheels. In some designs he added a fly-wheel to distribute the power more evenly.

Sketch for a diving suit and flippers for use under water. There are many such devices pictured in Leonardo's notebooks. He observed that a diver wearing one of these suits could approach a hostile ship, under water, and stay submerged long enough to bore a hole in its side, and withdraw to safety. The diver would breathe through a tube to the surface.

This machine for dredging harbours was mounted on two barges. The mud was deposited into other barges passing between them.

TOWN PLANNER

During the plague which devastated Milan in 1483, Leonardo worked on designs for a new township which would be more hygienic and so lessen the chances of further epidemics.



This reconstruction shows what Leonardo's ideal city might have looked like. One of his suggestions was that the streets should be as wide as the houses were high. Roads were to be on two levels, the upper one being 'for the convenience of the gentlefolk'.

'All carts and loads for the service and convenience of the common people should be confined to the low-level roads.'

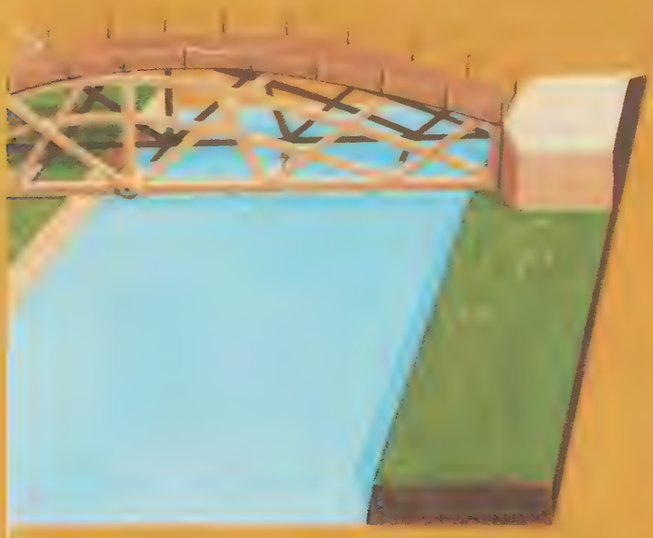
A swing-bridge. When not required for crossing the river, the bridge could be swung out of the way. A working model has been made of this.

CANAL CONSTRUCTION

All matters concerning the movement of water fascinated Leonardo, as we have mentioned before. He designed canals (one of them to link the city of Milan to the sea), locks, and a variety of pumping machines (many of them for draining marshes). He also designed a hydraulic 'screw' which was a forerunner of the present-day water turbine.

During a brief visit to Venice in 1499, Leonardo was consulted about the city's defences on the River Isonzo. (The Venetians were at that time engaged in a war with the Turks – in which they were doing none too well.) Leonardo inspected the surrounding countryside and suggested that the best way of keeping the Turks at bay would be to flood this land with water.

A typical design of Leonardo's for a canal lock. He arranged for the gates to be opened and closed from the bank of the canal, with the minimum of effort. But his main contribution to the design of canals and locks was his invention of the small gates within the doors of the lock. These allowed the water to rise to the required level smoothly, and with none of the rush which would ensue if the complete lock doors were opened immediately. This invention was, in fact, used some 50 years later.



AERONAUTICAL ENGINEER

Throughout most of his adult life Leonardo da Vinci dreamed of conquering the sky. He loved birds and studied them closely. Most of Leonardo's designs would have resulted in certain disaster had he tried them out, but he did have the vision to foresee that man would most certainly fly one day.

An intricate sketch for one of his flying machines. The wings were moved by the pilot's feet.

Unlike many of his 'flying' machines, this parachute would have worked.

Leonardo's famous forerunner of the modern helicopter. The flat, helical surface was supposed to be rotated very rapidly by the central pole which was connected with a wound-up spring. If the machine had been light enough it would surely have worked.

But, alas, although this helicopter might at least have worked, it now seems that Leonardo's idea was not an original one. Helicopter toys, rotated by a sharp jerk on a piece of string, can be seen in several paintings dating from around the time when Leonardo was alive.

QUEEN ELIZABETH I

A LIGHT snow was falling, and the sky was overcast. But the inhabitants of the city of London were not deterred by the weather, and a cheerful, colourful, and noisy crowd thronged the streets. It was 14th January 1559; the crowd had gathered to watch the procession of Elizabeth I, England's new Queen, on its way to her coronation at Westminster.

The long procession passed by. At its head came the trumpeters, heralds, and men-at-arms. The royal litter bearing the young Queen was attended by the gentlemen-pensioners, bearing gilt battle-axes, and a crowd of footmen in red velvet ornamented with red and white roses, and the letters E R – Elizabeth Regina. Elizabeth herself wore a magnificent robe, with the huge sleeves fashionable at the time. Her necklace and marvellous jewels brought out the pallor of her oval face, and a princess's crown gleamed in her red hair. The crowd was wild with joy, cheering and shouting 'God save the Queen!' Elizabeth smiled at their welcome, and kissed her hand to them. Ten years before, her young brother Edward had asked her if to be a king were really a great thing, and she had replied: 'There is nothing greater except for God Himself.'

Elizabeth was now Queen of England. This article is mainly concerned with the personality of a Queen who gave her name to one of the most brilliant eras in British history, the Elizabethan Age.

An unhappy childhood

Elizabeth was born in the royal palace of Greenwich on 7th September 1533. She was the daughter of Henry VIII and Anne Boleyn, his second wife. She was an unwelcome child, especially to her father, who desired a son to succeed him, and carry on the Tudor dynasty. Three years later Anne gave birth to a still-born son, and the King, angry at her failure to produce an heir, trumped up a charge against her and had her beheaded (see page 1711). Elizabeth was declared illegitimate, and much of her childhood was passed under a cloud, and in the company of governesses and tutors. She was an intelligent and gifted girl, and spoke Latin, Greek, French, and Italian.

In 1547 Henry VIII died, and was succeeded by the 10-year-old Edward VI, son of Henry's third wife, Jane Seymour. At this time Elizabeth was nearly 14. Edward ruled for only six years and was succeeded by Elizabeth's elder half-sister, Mary, daughter of Henry and his first wife Catherine of Aragon, a Roman Catholic. Elizabeth was accused of plotting secretly with the Protestants to overthrow Mary; she was imprisoned and on several occasions narrowly escaped death. She was saved only by her intelligence, tact, and extraordinary presence of mind.

Elizabeth as Queen

Queen Mary died in 1558 and was succeeded by Elizabeth, who was then just 25 years old. Although the new Queen was young, the years of plots and intrigues through which she had passed had given her the wisdom of an experienced statesman. Her first task was to strengthen the financial position of the country by various measures of economy. Court and government expenditure, which had risen to about £30,000 a month under Mary (who also left enormous debts behind her), was drastically reduced; in the first 12 years of Elizabeth's reign it averaged little more than £23,000 a month.

Elizabeth cared nothing that people should think her mean. She intended to govern herself,

The Great Seal of Elizabeth I, Queen of England (1558–1603)

THE LAST YEARS

When Elizabeth came to the throne, England was a country of only secondary importance. This brilliant and able Queen brought peace and prosperity to her land and won the love and admiration of her people. She held the great powers of France and Spain at bay for years, and in 1588 the attempt of Philip II to invade England with his Spanish Armada was thwarted by means of the powerful fleet which Elizabeth had built up through the genius of her sailors, Hawkins and Drake (see page 1988).

Her influence on her time was enormous, and it is only right that the period is known as the Elizabethan Age. Not only did England become rich and powerful; the arts flourished as never before.

An artist's impression of Elizabeth being carried in her litter to be crowned at Westminster

although Parliament had power to grant or withhold certain taxes, and she knew just how to manage those who served her. She had an unfailing instinct for judging just when to ask for money, and how much to ask for. Few serious quarrels arose between Elizabeth and her Parliaments, and by intelligence, persuasion, and feminine coaxing, she 'gives her orders and has her way as absolutely as her father did', as a Spanish observer wrote.

The one thing that Parliament insisted upon was that Elizabeth should marry. It was of the utmost importance that she should have a child to succeed her, otherwise the throne might pass to her cousin Mary Stuart, Queen of Scotland, who was a Roman Catholic and who was allied by marriage to the royal family of France.

Elizabeth replied in her usual manner to Parliament's insistence; she bargained with them. Her Parliament wished her to marry? If Parliament would grant her funds for enlarging the fleet, she would look into the matter of marriage. She had many suitors, and her policy was to discourage none of them, but to play them off against each other. One was Philip II of Spain, who wearied of this waiting game and married the daughter of Henry II of France. At this the English Queen murmured mockingly: 'Could he not wait another month or two to see how I should make up my mind?'

Elizabeth loved the game of courtship, as she loved other feminine things, like rich dresses and jewels. She is said to have had 3,000 dresses. She enjoyed hunting, balls, and festivities, which she attended tirelessly. She loved compliments upon her beauty, which she tried to preserve in her old age with cosmetics and false hair. She was surrounded by courtiers who gave her the masculine admiration she loved, men like the Earl of Leicester and the Earl of Essex. But her country came first; and though she enjoyed the flattery of her courtiers, it was upon 'Mr Secretary', William Cecil (later Lord Burghley), that she relied most, and whose advice and loyalty supported her nearly to the end of her life.

Among the Elizabethan poets and writers were William Shakespeare, Sir Philip Sidney, and Christopher Marlowe.

Elizabeth never married, despite the efforts of her Parliament and ministers to persuade her. Her heir was King James VI of Scotland, the son of Mary Queen of Scots. Mary herself had fled from Scotland to England in 1568, where she had proved a focus for Roman Catholic plots against Elizabeth. It was only after considerable provocation that Elizabeth finally ordered her execution in 1587.

In January 1603, Elizabeth went to her palace at Richmond, in Surrey. She was then 69, and had reigned for about 45 years. Two months later, she took cold and developed a high fever. Early in the morning of 24th March, the Queen died 'as the most resplendent sun setteth at last in the western cloud'. With her death the Tudor dynasty ended, and the Stuart Age began.

The Elizabethan church settlement

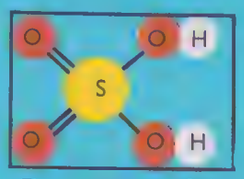
Throughout her life Elizabeth kept strictly to her famous principle of the *via media* – the middle course. Caution was her watchword. Nowhere was her caution more valuable than in religious matters, where she had to steer a course between the 'right wing' Catholics and the extreme Puritans, the returning 'Marian exiles', on the left. Basically, her policy was one of compromise. She kept her Bishops, Sacraments, and ceremonial (to the disgust of the Puritans), but abolished the Catholic Mass and rejected Papal supremacy. Only after she was excommunicated by Rome in 1570 were severe penal laws enforced against Catholics.

SULPHURIC ACID

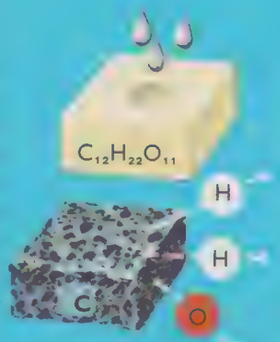
SULPHURIC acid is one of the most important and widely used of all chemical substances; it is a vital material for the modern chemical industry. The importance of this acid can be seen from the fact that over 50 million tons of it were produced in 1961. It is uncertain when sulphuric acid was first discovered. Some historians of chemistry think that it was known in mediaeval times, but others feel that it was not definitely described until the end of the 15th century. At that time it was made in Germany by the distillation of 'green vitriol' (iron sulphate) or 'blue vitriol' (copper sulphate) and for this reason was known as 'oil of vitriol', a name which is still occasionally used for it. Although it has a long history, it was not until the 18th century that it was produced in large quantities for industrial use.

PROPERTIES OF SULPHURIC ACID

Sulphuric acid has the chemical formula H_2SO_4, and its molecule is therefore made up of two atoms of hydrogen, one atom of sulphur, and four atoms of oxygen. These atoms are linked together as shown in the illustration on the right. The acid is a dense, oily liquid with a specific gravity (see page 1980) of 1·84 and a very high boiling point of about 340°C. It is highly corrosive to most substances and causes severe burns if it is spilt on the skin. The destructive action of the acid on skin and other organic materials is due to the great attraction which it has for water. It will extract water from many substances containing hydrogen and oxygen and cause them to char. If the acid is dropped on to a lump of sugar so much heat is given out that the sugar is converted to carbon by the loss of water. Concentrated sulphuric acid left exposed to the air picks up moisture and becomes diluted.



The arrangement of the atoms in a molecule of sulphuric acid



The charring of sugar in contact with sulphuric acid

One or both of the hydrogen atoms of sulphuric acid can be replaced by a metal to form a salt. The salts of sulphuric acid are of considerable importance. Copper sulphate is used in agriculture as a fungicide; sodium sulphate (Glauber's salt) and magnesium sulphate (Epsom salt) are used in medicine; calcium sulphate is plaster of Paris; and barium and lead sulphates are used in paints.

PREPARATION

Originally the acid was obtained from iron or copper sulphate. In the 17th century it was found that it could be obtained by burning a mixture of sulphur and 'nitre' (potassium nitrate) in a large glass globe, and absorbing the gases given off in water. Although this was a more convenient method of preparation than the earlier one, the acid was not obtainable cheaply, or in quantity, until John Roebuck began to make it in Birmingham, in 1746, by the Lead Chamber process. In this process sulphur mixed with nitre was burnt in dishes in huge lead-lined chambers, the floors of which were flooded with water. Ten of these chambers worked day and night, and the dilute acid which formed on the floor was drained off from time to time and concentrated by distillation. The process was improved throughout the 18th and 19th centuries. The size of the chambers was increased enormously, and it was found that air could be used to replace most, though not all, of the nitre. The Lead Chamber process was used extensively in Britain until after 1914, but after the First World War it was rapidly replaced by the Contact process.

In this process the acid is formed by passing a mixture of air and sulphur dioxide gas over a catalyst (see page 1878) made of platinum or vanadium. The sulphur dioxide combines with the oxygen in the air, in the presence of the catalyst, to form sulphur trioxide, and sulphuric acid is formed by dissolving the sulphur trioxide in water.

Both the Lead Chamber process and the Contact process involve the oxidation of sulphur dioxide to sulphur trioxide, either by the oxygen present in potassium nitrate, or by the oxygen of the air, and the subsequent formation of sulphuric acid by the combination of this sulphur trioxide with water. The following equations illustrate these reactions:

$2\ SO_2$	+	O_2	=	$2\ SO_3$
Sulphur dioxide		Oxygen		Sulphur trioxide
SO_3	+	H_2O	=	H_2SO_4
Sulphur trioxide		Water		Sulphuric acid

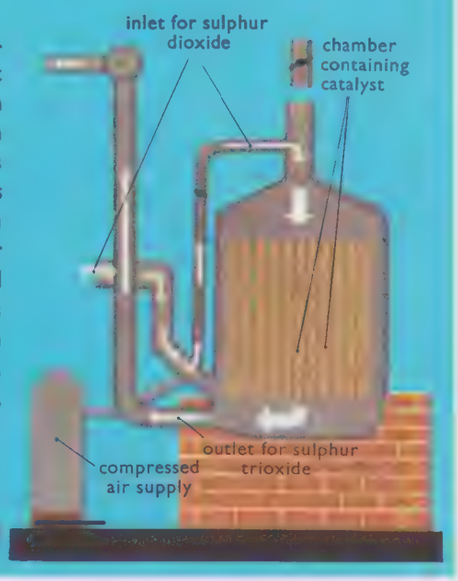
USES

There are so many uses of sulphuric acid that we can only mention a few of them here.

By far the most important use is in the preparation of agricultural fertilisers, especially of superphosphates and of ammonium sulphate. This accounts for about 70 per cent of world production of sulphuric acid.

Another important use is in the manufacture of rayon (about 10 or 12 per cent). It is also used in the iron and steel industries for pickling these metals to remove rust scale, and in the making of paint, explosives, plastics, dyestuffs, and drugs. Sulphuric acid is also used in the purification of petroleum products, and as the electrolyte in storage batteries.

The total world production of 100 per cent strength sulphuric acid in 1961 was over 50 million tons. The United States produced 16·2 million tons and the United Kingdom 2·7 million tons. The other main producers are listed here (figures in millions of tons). Russia 5·4, Japan 4·7, West Germany 3·1, Italy 2·4, France 2·2, Canada 1·5.

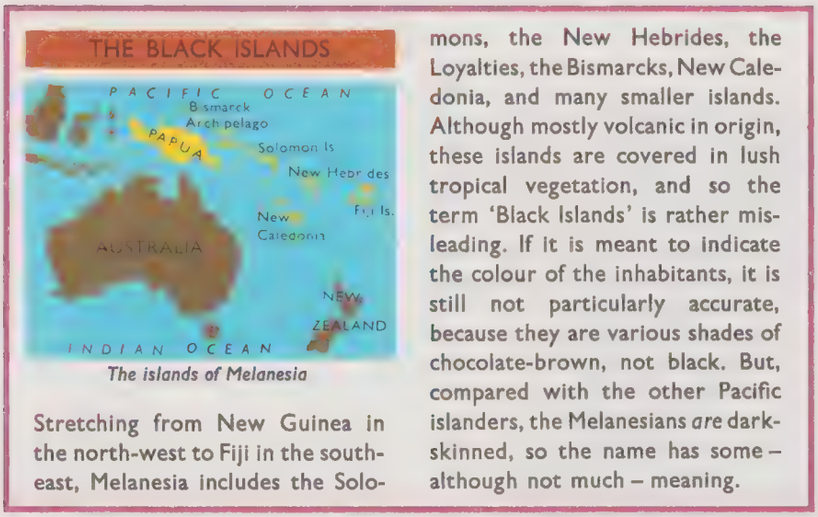


Production of sulphuric acid by the Lead Chamber process

THE MELANESIANS

THE islands of the central and western Pacific Ocean are divided into three great geographical divisions: Polynesia, Micronesia, and Melanesia. These divisions are purely geographical and do not necessarily indicate any common culture, or even common racial origin, among the people who live on the islands.

Their names all come from Greek words. The name of Polynesia comes from the Greek *poly*, many, and *nesos*, island. Micronesia is derived from *micros*, small, and *nesos*, while Melanesia comes from *melanos*, black, and *nesos*. Thus the Melanesian islands are sometimes referred to as the 'Black Islands'.



The islands of Melanesia

Stretching from New Guinea in the north-west to Fiji in the south-east, Melanesia includes the Solomons, the New Hebrides, the Loyalties, the Bismarcks, New Caledonia, and many smaller islands. Although mostly volcanic in origin, these islands are covered in lush tropical vegetation, and so the term 'Black Islands' is rather misleading. If it is meant to indicate the colour of the inhabitants, it is still not particularly accurate, because they are various shades of chocolate-brown, not black. But, compared with the other Pacific islanders, the Melanesians *are* dark-skinned, so the name has some – although not much – meaning.

A Solomon Islander. His ornaments are made of shells

Origins and language

There are about 1,250,000 people living on the islands of Melanesia, but it is almost impossible to classify them as belonging to any particular ethnic, or racial, group. They probably originated from a somewhat primitive type of man from south-east Asia, although the original physical characteristics have been considerably altered by successive migrations from Asia. They are predominantly dark-skinned, and their hair can be either straight or curly, although the frizzy effect is deliberately cultivated. Negroid characteristics, such as thick lips, are not often seen. A wide variety of languages is spoken, and although most of them developed from a language which was spoken along the south China coast about 5,000 years ago, the people who speak one cannot usually understand another.

Religion and character

The Melanesians traditionally believed that the spirits of their dead relations look after their welfare, and that they must guard against sorcerers and evil spirits.

Most Melanesians are now Christian, at least nominally. Head-hunting and cannibalism used to be quite widespread, but these practices were usually part of the traditional religions and have tended to die out as Christianity has spread.

The Melanesians are very shy and hesitate to do business or ask favours, except through a third party. They will only tell you their names very reluctantly, and when angry with somebody will smash up inanimate objects such as their own canoes and houses rather than attack the actual offender.

SOCIAL ORGANISATION

A men's meeting house

Melanesian villages consist of between 100 and 500 people, who co-operate in fishing and hunting expeditions. But family, or kinship, ties are much more important than those of the village.

Competition is an essential characteristic of community life in Melanesia, and the ability to work hard and trade successfully, and, to a lesser extent, fighting prowess, are great advantages.

A man is obliged to help others in making gardens and building houses and canoes. There is no payment, apart from a meal at the end of the day's work, but a man will expect others to do the same for him. A man is also expected to contribute towards buying a wife for one of his family.

A PRIMITIVE SOCIETY

When the first white men arrived in Melanesia they caused havoc with their firearms, new diseases, and slavery.

But conditions have improved since then, and the islanders are now well provided with medical and educational services.

Traditional crops are taro, yams, and sweet potatoes, while fishing and hunting add to the food supply. The islanders trade widely in food, obsidian (a hard, glassy, volcanic rock), and shells. Ritual dances are also frequently exchanged between the different tribes.

Obsidian and flint were sometimes used for the heads of spears

THE JEWISH RELIGION

JUDAISM is often regarded as the mother-faith out of which both Christianity and Islam developed. All three faiths date back to Abraham, who, living among idol-worshippers, discovered the one, true, invisible God, and dedicated his life to teaching his fellow-man about Him. Then, about six centuries later, Moses and the Israelites received the *Torah* (teaching) at Mount Sinai. This recounted Israelite history from the creation of the world, and revealed the way in which the one God wished to be served. These two features – belief in one God, taught by Abraham, and the service of Him through observance of the Torah, taught by Moses – are the basic principles of Judaism.

Torah and Talmud

Strictly speaking, the Torah consists of the first five books of the Old Testament, known as the Five Books of Moses. But in Jewish life the word Torah has come to have a much wider meaning. It stands for authoritative Jewish teaching, and so Torah may be found both in the Bible and in later inspired books. The Torah gave rise to many commentaries, interpretations, and codes of conduct, which were passed on by word of mouth for many centuries. The massive task of editing and committing them to writing was undertaken between the 2nd and 5th centuries A D, and the result was the *Talmud* (learning), a great work of 63 volumes. Apart from ethical and moral teaching, the Talmud contains closely reasoned discussions on Jewish law, and information of historical, social, and even scientific importance.

The 13 principles of faith

These principles of the Jewish faith were formulated by Moses Maimonides in the 13th century A D:

(1) God created all things; (2) There is only one God; (3) God has no bodily form; (4) God is eternal; (5) One must pray to God only; (6) All the words of the prophets are true; (7) Moses was the greatest of the prophets; (8) The Torah which we have is the same that was given to Moses; (9) The Torah will never be changed; (10) God knows every deed and thought of man; (11) God rewards good and punishes evil; (12) The Messiah will come in the future; (13) In the future there will be a resurrection of the dead.

Jewish festivals

Judaism affects the whole way of life of its followers, for it is the actions of a person, according to Jewish teaching, that show the sincerity of his beliefs.

Jewish law is concerned with every moment of the day and with the important days of the year, which almost all recall historical events and provide occasions to put into practice the ethical ideas of Judaism.

A Rabbi reading from the Scrolls of the Torah

The *Jewish Sabbath* is a day of complete rest from work, lasting from sunset on Friday until nightfall on Saturday. The Bible command 'Six days shalt thou labour and do all thy work' teaches both that work is honourable, and that all have the right to rest. On the Sabbath Jews attend the Synagogue services, and the family gathering at which a blessing is said over wine, the symbol of joy, with candles, which shed light and peace, on the table.

Passover, in March or April, marks the deliverance of the Israelites from slavery in Egypt, and stresses every man's right to freedom. The traditional Passover food is *Matzah*, unleavened biscuits, recalling the 'bread of affliction' which the slaves ate in Egypt.

Pentecost falls seven weeks after Passover. It is the time of the wheat harvest in Israel, and in ancient times a thanksgiving offering was brought to the temple in Jerusalem on this festival. Pentecost is also the anniversary of the giving of the Torah at Mount Sinai, and is thus an occasion for renewed allegiance to the laws of God.

Tabernacles, in September or October, occurs at the end of the fruit harvest in Israel. Its symbol is the *Succah*, or frail harvest booth, in which the Israelites dwelt while on their way through the wilderness to the Promised Land. The Succah symbolises the uncertainty of life and the need for God's protection.

Rosh Hashanah (the New Year) occurs in September and is the anniversary, according to Jewish reckoning, of the creation of the world. On this day the Creator reviews the state of His creation and examines the deeds of men. During the Synagogue service a ram's horn trumpet (the *Shofar*) is blown as a call to spiritual wakefulness.

Yom Kippur (the Day of Atonement) is a 25-hour fast spent in the Synagogue in prayer. The Jew asks God's forgiveness for the lapses of the past year and makes resolutions to improve his conduct in the future. Yom Kippur falls ten days after Rosh Hashanah.

The Synagogue

Jewish worship takes place in the Synagogue (from the Greek *syn*, together, and *agein*, to bring). At one end of the Synagogue building is the Ark, a curtained recess in which are kept the Scrolls of the Torah. These are written in unpunctuated Hebrew on parchment, and are read in public on Sabbaths, festivals, and certain other days. There are no ordained priests in Judaism; every Jew has the right and the privilege to learn the Torah, and to become a *Rabbi*. The word 'Rabbi' actually means 'teacher', though the Rabbi not only teaches but carries out the usual duties of a minister of religion.

The Jews today

The total Jewish population of the world is just over 12 million. Six million Jews perished in Nazi Europe, including many great scholars and outstanding personalities. Today the largest Jewish community in the world is in the United States of America, where over five million Jews live. There are over two million Jews in the State of Israel, which is today the spiritual and cultural centre of world Jewry.

Israel's land frontier is adjoined by unfriendly Arab states – but there is a feeling of self-confidence about the new state, together with a sense of national pride.

ORDEAL BEFORE MILLIONS

Apart from writing regular topical features for *Knowledge News*, Hugh Moran is in charge of the Information Desk on the ITV programme *Tuesday Rendezvous*. This week he tells us about some of the horrors, joys, and excitement of appearing on television before millions of young people.

THE second hand on the studio wall clock moves rapidly forward in what looks like a series of convulsive jerks. The floor-manager looks tense as he holds up ten fingers; ten seconds to go before I make my first live television appearance before millions of viewers.

Nine, eight . . . I can feel the beads of perspiration forming at my temples. My tongue has turned into a large ball of cotton wool; in my panic I feel certain that I will never be able to speak.

Seven, six, five . . . the floor-manager is tucking his fingers down into his palms in time with the seconds . . . Cape Canaveral was never like this.

Four, three, two . . . I blink, re-adjust my engaging expression, and look into the horrible, all-seeing lens once again.

One, zero . . . the red light winks on just below the camera lens, and I (at least, I think it is I) am saying 'Hello'.

I managed to complete that first appearance successfully, although I now only vaguely remember the details of it. But I went through the same agony for several weeks after that during my early appearances on Associated-Rediffusion's young people's programme, *Tuesday Rendezvous*.

Now, with practice, I am much more comfortable before the cameras. But do not let anyone ever tell you that appearing on a live television programme is easy. It is not.

On *Tuesday Rendezvous*, for instance, there may be up to six or seven different items, and they all have to be transmitted from the one studio. These items have to be timed exactly to the second so that the cameras can get to their places at the right time. All this is the responsibility of the director and his assistant, who sit in front of a battery of monitor television screens in their control-room above the actual studio.

The director passes his instructions to the camera crews, to the sound men on their boom microphone platforms, and the floor-manager and his assistants who make sure that everyone on the studio floor operates smoothly.

Most of the time things *do* go smoothly. But, of course, like in any other organisation, there are moments when things go wrong.

In my part of the programme I deal with general knowledge questions, which are often illustrated with film. This film, naturally, has to fit in with my commentary. I remember once talking happily about the Eiffel Tower – when it was built, by whom, and so on – but when I happened to glance at the monitor set in the studio, it was showing some excellent film of the *Flying Scotsman* travelling at speed.

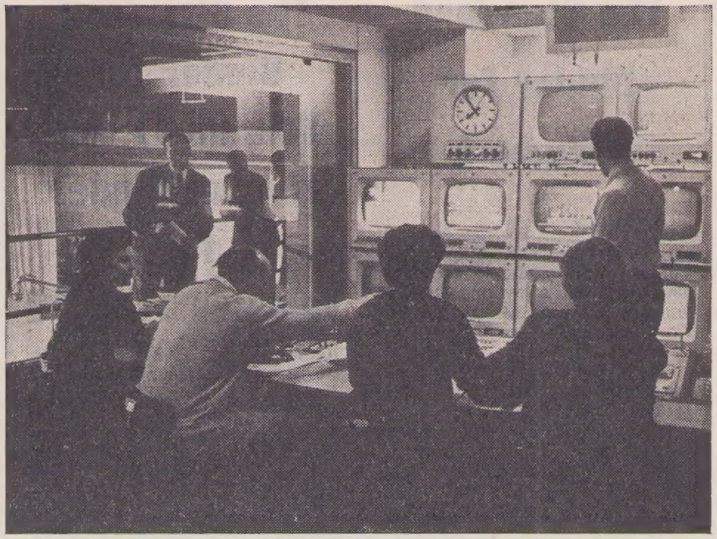
I quickly changed to the history of this famous train, but, to my horror, the whole thing dissolved into a film of the *Queen Mary* steaming majestically out of Southampton. I think we finished that particular programme with me talking about Niagara Falls while the film showed the Lord Mayor's Show.

Another time my item followed the appearance of Grahame Dangerfield, the naturalist, who had been showing a particularly spiteful black-headed gull in another corner of the studio.

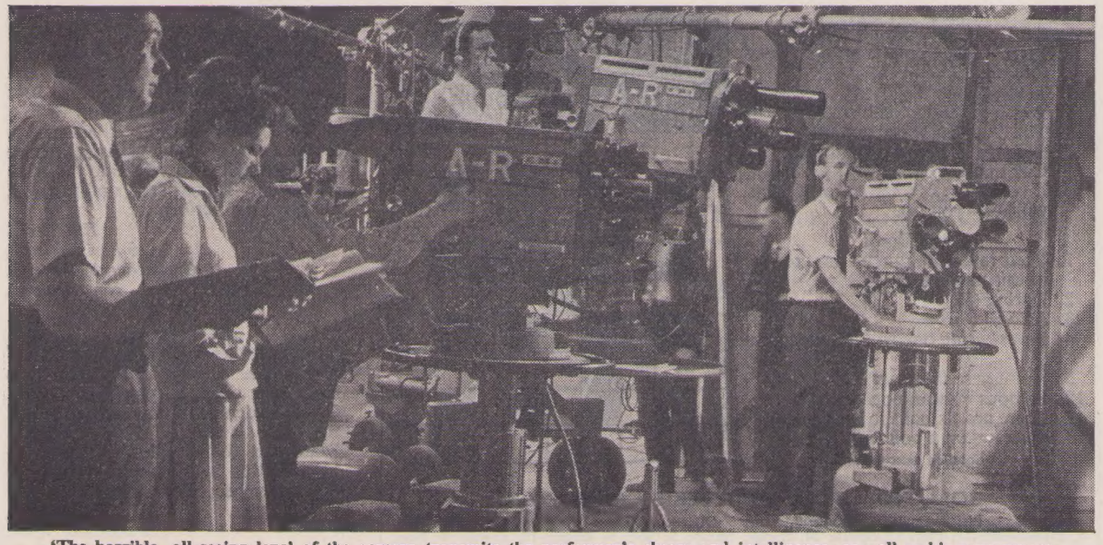
He finished by saying: 'Now, over to Hugh Moran' . . . and the gull hopped smartly off the table and marched determinedly in my direction. As I began my talk I could feel the gull nudging my trouser leg. This was followed by a short, sharp peck at my exposed ankle. I fixed my face in a sickly smile, much to the amusement of the camera crew, and the consternation of the director, who hissed into his microphone: 'What's the matter with Hugh? Is he in pain or something?' He was right – I was!

During a programme some weeks ago one of the studio hands, bearing a large pot of red marking paint, went to cross a tangle of camera cables. Just at that moment the camera moved away in another direction. The studio hand came crashing down, together with the paint, which landed in his hair and ran gently down his face; he had to sit there for a full two minutes before he could move without interfering with the camera.

So you see, apart from the nerves and tension, it can often be quite good fun appearing on television.



In the control-room the director looks at the pictures shown on the monitor screens – he points at the picture he wants transmitted to the public.



'The horrible, all-seeing lens' of the camera transmits the performer's charm and intelligence, as well as his nervousness and incompetence.

Did you know . . . ?

Many church spires are topped by a gold cock. The reason for this is a mixture of pagan superstition and early Christian beliefs. The cock, a symbol of watchfulness, was sacred to Minerva, the Roman goddess of wisdom, and could not be offered in sacrifice. Later, when Christianity came, the Pope commanded that a cock should be placed on every church steeple to remind people of St Peter's denial of Our Lord.

The statutory length of a coil of rope is 240 yards. The long passages where the rope is actually made are called 'rope walks'. About 13,000 people are employed in the rope trade in Britain. They produce about £20,000,000 worth of rope each year. This may seem a large figure, but one single mooring-rope for a liner can cost up to £1,000 if made of Terylene or nylon. A manilla rope costs about £350 and, with careful treatment, should last many years. Ropes made from reeds by the ancient Egyptians 4,000 years ago have been discovered in good condition.

REMINDERS

The Standard Binder for Volume 2

Readers of Blue *Knowledge* can still get their standard binder for Volume 2. They should see their newsagent right away, or in case of difficulty write to Department B, Knowledge, 37 Hertford Street, London W.1.

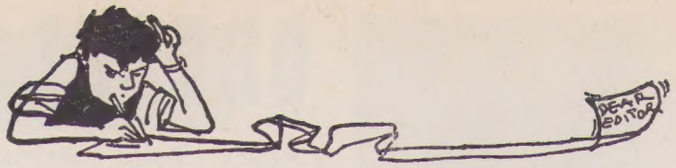
The standard binder for Volume 2 is exactly the same as the one they got free for the first volume.

It costs 3*s.* 6*d.* There is an extra charge of 1*s.* 3*d.* on each order from Department B, but more than one binder can be ordered with still only a 1*s.* 3*d.* charge for postage and packing.

This announcement does not concern Easibinder collectors.

The Standard Binder for Volume 11 and the Easibinder for Volumes 11 & 12

Readers of Black *Knowledge* can still get their standard binder for Volume 11 or their Easibinder for Volumes 11 and 12. They should see their newsagent right away, or in case of difficulty write to Department B, Knowledge, 37 Hertford Street, London W.1. There is a 1*s.* 3*d.* charge for postage and packing on each order from this department, but more than one binder can be ordered for the same charge.



Island Friends

DEAR EDITOR—Our members would very much like English penfriends. If any *Knowledge* readers are interested, perhaps they would write to me.

W. S. Arthur,
Pen Pal Associates, Box 118,
Bridgetown, Barbados, B.W.I.

Crown, Bell and Lion

DEAR EDITOR—Your article *Signs and Signboards* (*Knowledge* No. 66) prompted me to read more about widely used inn signs.

There are more Crown Inns in Britain than any other, well over a thousand. This may have started when the inn was on Crown property, and the numbers grew as a symbol of loyalty to the throne.

The Bell is another popular sign. There are about 500 inns bearing this sign today; most of them being very near the parish church.

There are several hundred signs which feature the king of beasts – the lion. Long ago the lion appeared on banners and shields, and was first included in the Royal Arms in the reign of Edward III.

P. Marcan (*age* 11),
Vaucluse, Treadaway Hill,
Flackwell Heath, Buckinghamshire.

Keeping a Look-out

DEAR EDITOR—I was glancing through some copies of *Knowledge News*, when I came across an article about the chameleon. This reminded me of an old Zulu legend.

It is said that when God had created the earth, He realised that everything in it was bad, the worst being man. He wanted to find someone who could tell Him of all the bad things the people on earth had done. Then He saw the chameleon, sitting on a leaf, offending nobody.

God picked it up, and put it on His lap, putting forth His proposition, which was to be a spy for God. However, the chameleon said that it was so slow it would easily be caught spying. So God gave it the gift of assuming the colour of the leaf it was sitting on. Then the chameleon said that it could not possibly see everything that was going on, so it was given the power to move each eye in a different direction.

For these reasons, the Zulu is always careful when he sees a chameleon.

P. W. Pritchard,
81 Balmoral Drive,
Durban North, Natal,
South Africa.

City of Variety

DEAR EDITOR—I am sure many people are like me, and enjoy reading about cities all over the world. I live in Christchurch, in South Island, the second largest city in New Zealand.

Christchurch is known by three names: the Garden City; New Zealand's little bit of England; and the City of Bridges. These names were given because the city is laid out like the towns of England, with a square and cathedral in the centre. There are also many parks and gardens; Hagley Park and the Botanical Gardens alone cover 200 acres. The river Avon and the Heathcote river both meander through the city, so that many bridges had to be built over them.

Christchurch is also sometimes referred to as the City of the Plains, because it is built on the largest plain in New Zealand.

Although only 113 years old, Christchurch has a population of over 250,000. Two main festivals are held here every year. In the floral festival shows, parades and thanksgiving services are held. The Christchurch on Avon festival is to celebrate the birth of William Shakespeare, and many of his plays are performed.

Jim Steele,
6 Parish Street,
Christchurch (*Zone* 6),
New Zealand.

A New Club

DEAR EDITOR—With another reader of *Knowledge*, I have formed a club for collectors of matchbox labels. Other readers have now joined, so that the club is called 'The *Knowledge* Matchbox Label Club'. Please announce this in *Knowledge News*, so that other people can join.

M. Smith,
12 Clarence Road,
Lowestoft North, Suffolk.

How much do you know about Scotland?

1. Loch Ness is part of a long waterway which cuts Scotland diagonally in two. What is it called?
2. What is sometimes called 'The Athens of the North' and why?
3. What place in Scotland is regarded as the home of the game of golf?
4. A film which was very popular not long ago was *Greyfriars Bobby*. What was it about?
5. Can you associate these football teams with their towns: Celtic, Queen of the South, Heart of Midlothian, and St Johnstone?
6. Marmalade, jute manufacture, shipbuilding, and cake – which town in Scotland do these remind you of?
7. What are (a) the Trossachs; (b) the Sassenachs?
8. Scott wrote the novel and Bizet the music of *The Fair Maid of* ——.
9. For what is the Pass of Glencoe famous?
10. Scotland's most famous poet was born at Alloway, near Ayr. Who was he?
11. What is a native or resident of Glasgow called?
12. Which is 'The Granite City'?

ANSWERS

1. *Caledonian Canal.*
2. *Edinburgh, for its monuments on Calton Hill, particularly the one to soldiers who died in Wellington's campaigns; also as a centre of culture.*
3. *St Andrews.*
4. *A faithful dog which for 12 years sat near its master's grave in Greyfriars churchyard, Edinburgh – a true story.*
5. *Glasgow; Dumfries; Edinburgh; Perth.*
6. *Dundee.*
7. *(a) Beauty spot near Callander; (b) those living 'south of the Border' – the English.*
8. *Perth.*
9. *Massacre of the MacDonalds, 1692.*
10. *Robert Burns.*
11. *Glaswegian.*
12. *Aberdeen.*

BRAIN ? BOX

1. Can you put words in the gaps to fit the clues outside the brackets? Each pair of words is pronounced the same but spelt differently.

   You turn it (——; ——) ships tie up at it.

   You feel it (——; ——) you look through it.

   The Queen does (——; ——) horses need them.

   You moan for something (——; ——) people drink it.

   Carpenters use it (——; ——) you see it on a map.

2. (a) Exist; (b) wickedness; (c) beastly; (d) thin curtain; (e) one of the sons of Jacob: (f) English river or saint for a cheese.

   These are clues to six words, each made of the same four letters differently arranged. Can you get them?

3. ROSETTA STONE

   (a) Woman explorer in West Africa?

   (b) Trade name for pinkish grey paint?

   (c) American novelist?

   (d) Centre stone of flat pavement from which wedge-shaped stones radiate?

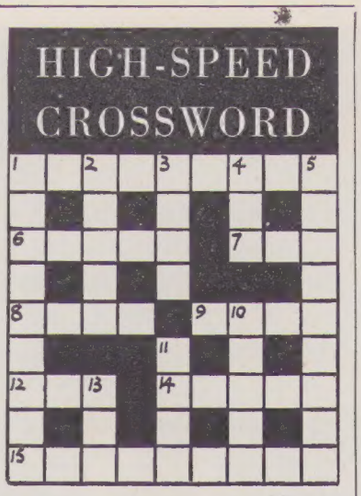
   (e) Famous stone covered with hieroglyphics found in Egypt and now in the British Museum?

   Which is it?

ANSWERS

1. KEY, QUAY; PAIN, PANE; REIGNS, REINS; WHINE, WINE; PLANE, PLAIN.
2. (a) Live; (b) evil; (c) vile; (d) veil; (e) Levi; (f) Ivel.
3. (e).

HIGH-SPEED CROSSWORD



Clues Across

1. Australian marsupials (9).
6. Frightening creatures of fairy lore (5).
7. Tree (3).
8. Welsh vegetable emblem (4).
9. The first man murdered (4).
12. River for a Spanish gentleman (3).
14. Call upon (5).
15. If you make a 14 across, your hosts will —— you (9).

Clues Down

1. Your favourite pursuit as a reader of this magazine? (9).
2. Daring (5).
3. As well (4).
4. Keats wrote one to a Grecian urn (3).
5. Not a wise fellow (9).
10. Famous Persian port (5).
11. There are six balls in each one (4).
13. It screws on a bolt (3).

Solution next week.

SOLUTION TO LAST WEEK'S CROSSWORD

ACROSS: 1, Pit; 3, Oasis; 6, Along; 7, Run; 8, Errand-boy; 11, Fog; 12, Speak; 14, Earns; 15, Eel.

DOWN: 1, Plate; 2, *Two*; 3, Organists; 4, Shrub; 5, Son; 9, Roger; 10, Yokel; 11, Foe; 13, Eve.

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mented with rocket missiles and by 1942 were developing the A-4, better known as the V-2. It was 47 feet long and weighed about 12½ tons, with a warhead weighing just under a ton. It reached a speed of 3,600 m p h and a height of 60 miles, developing a thrust of 27 tons.

After the war the Americans further refined the design of the V-2; the W A C Corporal missile, taken up about 20 miles by a V-2, reached a height of 250 miles.

The break-through

A spectacular advance in space flight came in 1957. On the night of 4th October the Russians launched a three-stage rocket weighing about 100 tons. This carried into orbit a sphere weighing about 184 pounds which began to travel round the earth. At its highest point it was 568 miles up. The name of this artificial satellite was *Sputnik*, which is Russian for 'companion'. It accompanied the earth in its orbit in the same way as the moon, which is a natural satellite. A month later the Russians sent up a second Sputnik.

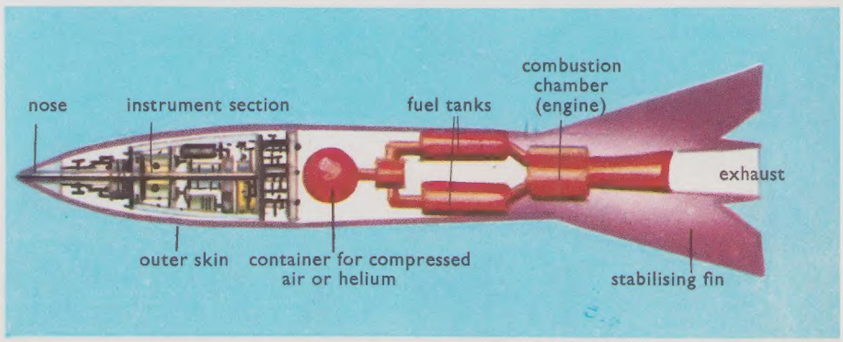
To learn to co-ordinate movement and balance, U S astronauts are trained in transport planes flying loops. This produces weightlessness for a few seconds. Bodily functions such as breathing, eating, and the ejection of waste matter do not depend on gravity and can be performed in conditions of weightlessness

The Americans launched their first satellite, which weighed just over 30 pounds, on 31st January 1958, using a four-stage Jupiter rocket. Since then more satellites have been launched, both by the Russians and the Americans. These earth 'companions' register and signal back to earth much useful information about the outer atmosphere: temperature, air density, cosmic ray intensity, the effect of space dust on the satellite's surface, and so on. All this information is vital in designing cabins in space-craft to carry men.

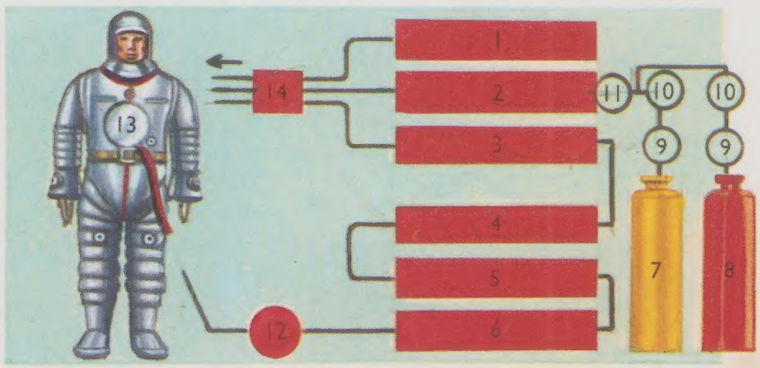
Manned flight

Research in 'space medicine' is advancing rapidly. Engineers design equipment to enable passengers in space to survive the extreme conditions of acceleration on take-off and weightlessness in orbit. Physiologists study the effects of space travel on the human body. The actual speed at which a space-craft travels is not the main problem. More important are changes in speed in *acceleration* (going faster) and *deceleration* (going slower). During these changes, the human body is submitted to great pressures.

A SINGLE-STAGE ROCKET AND ITS PARTS



The rocket motor works on a 'recoil' principle. Its forward movement is provided by the violent expulsion of gas made by burning fuel. The rocket does not need to 'thrust' against the atmosphere and so it can function perfectly in outer space



Space suit with a diagram of the complicated equipment necessary for the wearer's survival outside the earth's atmosphere. ① Cooling apparatus; ② temperature control apparatus; ③ heating apparatus; ④ purifier for gas to be reused; ⑤ eliminator of the carbon dioxide produced by breathing; ⑥ eliminator of the excess water produced daily by the human body; ⑦ reserve oxygen container; ⑧ reserve container for helium; ⑨ valves for reducing gas pressure; ⑩ hand-operated valves for opening and closing ⑪ valve controlling recirculation of purified gases; ⑫ pump to keep gas circulating; ⑬ hermetically-sealed suit; ⑭ safety valve for high pressure (when the outside atmosphere becomes rarefied)

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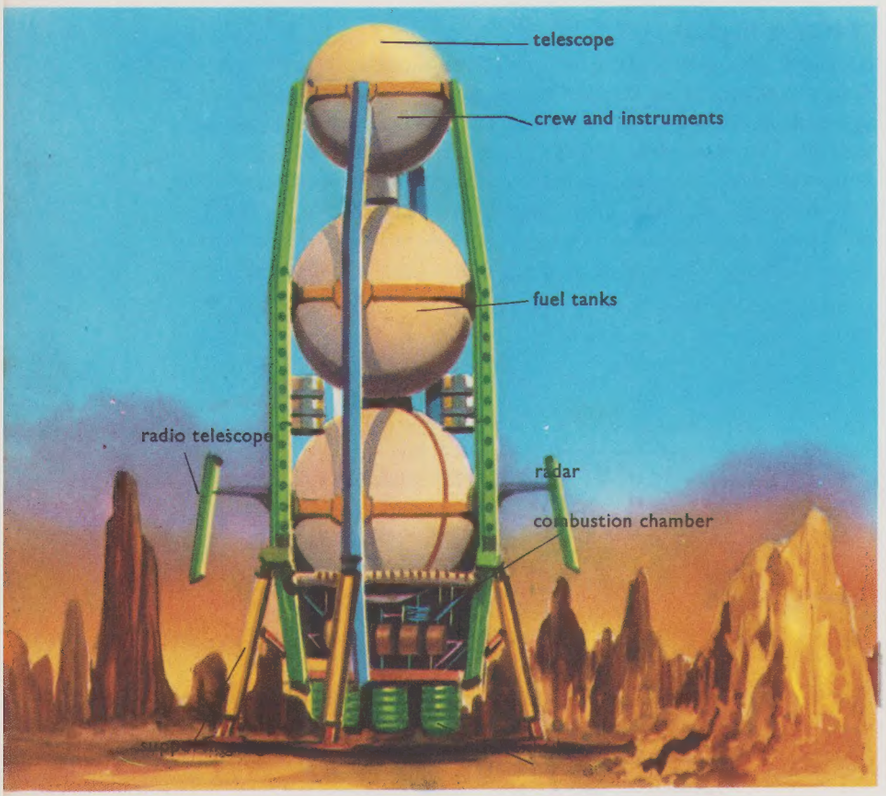
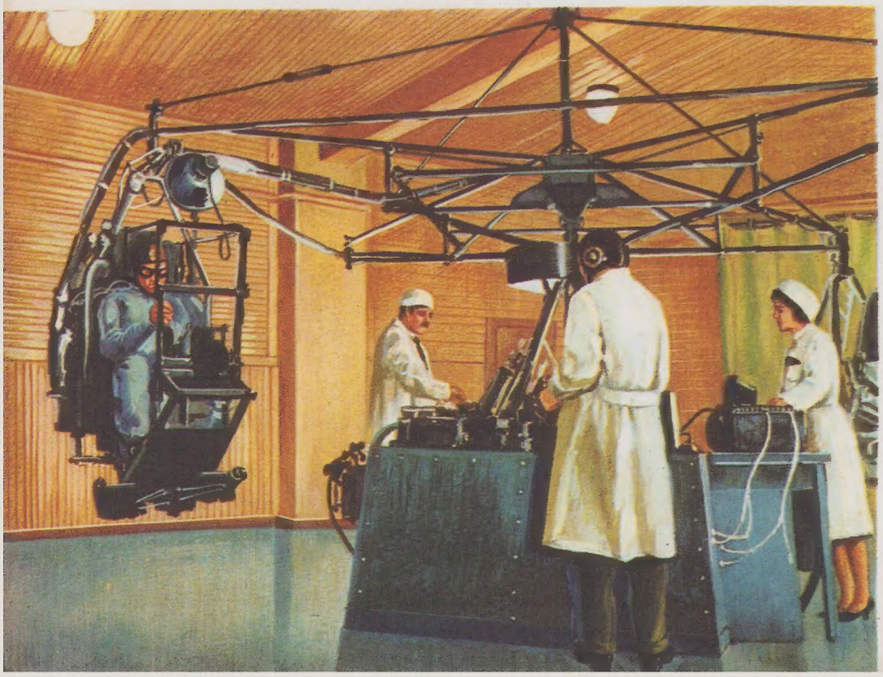
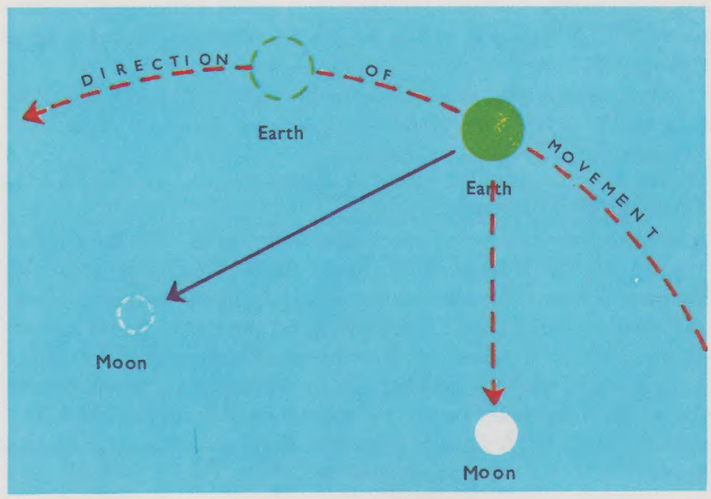


A suggested space-ship, designed by the Americans, which could carry and land men on the moon

A centrifuge in a Russian laboratory for space medicine whirls 'cosmonauts' round at speeds which subject them to take-off pressures. Results are recorded on instruments. In space travel the acceleration of take-off has the effect of great pressure on the body. Once the acceleration has stopped, the speed of travel is not felt





Aiming at the moon is like shooting at any moving target. One does not aim at where the target is, but at where it will be by the time the missile reaches it, as shown in the simplified diagram

In 1960 the Russians sent dogs into orbit and managed to bring them back to earth. On 12th April 1961 Yuri Gagarin became the first man to circle the earth. A sub-orbital flight (not circling the earth) was made by the American Alan Shepard on 5th May. On 6th August 1961 another Russian, Gherman Titov, was sent into orbit and stayed there a whole day.

Since then the Americans have sent four manned satellites into orbit, and the Russians two simultaneous ones. The two cosmonauts (as the Russians call their space pilots) on this flight maintained radio contact with each other as they circled round the earth. This successful flight showed that it might soon be possible for satellites which had been sent up separately to meet in space and enable space-stations to be built.

'Probes' to the planets

The next task is to land a space-craft on the moon, by using reversed rocket jets as brakes. Before a manned flight to the moon can be undertaken we have to solve the problem of take-off from the moon's surface for the return journey to earth.

Meanwhile, rocket 'probes' have already travelled much farther than the moon. In December 1962 an American space 'probe', after months of travel, reached the neighbourhood of the planet Venus and radioed back temperature recordings. From this it appeared that the surface of Venus is too hot to support life (about 800°F). Similar exploratory rockets will no doubt be sent to other planets in due course.

The latest idea for constructing the space-ships required for manned flights to the moon or the planets is to build the craft from sections shot up into orbit separately. The craft could then be fired farther off into space by short bursts of rocket jets. Very little more acceleration is needed to propel an object that is already in orbit round the earth.